COLLINS

# 51J-3
# COMMUNICATIONS RECEIVER

# INSTRUCTION BOOK

# INSTRUCTION BOOK

for

# 51 J-3 COMMUNICATIONS RECEIVER

Manufactured By

COLLINS RADIO COMPANY
Cedar Rapids, Iowa

520 9523 00

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## GUARANTEE

The equipment described herein is sold under the following guarantee:

Collins agrees to repair or replace, without charge, any equipment, parts or accessories which are defective as to design, workmanship or material, and which are returned to Collins at its factory in Cedar Rapids, Iowa, transportation prepaid, provided that the foregoing shall not be applicable to.

(a) Equipment or accessories as to which notice of the claimed defect is not given Collins within one year from date of delivery;

(b) Equipment and accessories manufactured by others than Collins, tubes and batteries, all of which are subject only to such adjustment as Collins may obtain from supplier thereof;

(c) Equipment or accessories which shall fail to operate in a normal or proper manner due to exposure to excessive moisture in the atmosphere or otherwise after delivery, any such failure not being deemed a defect within the meaning of the foregoing provisions.

Collins further guarantees that any radio transmitter described herein will deliver full radio frequency power output at the antenna lead when connected to a suitable load, but such guarantee shall not be construed as a guarantee of any definite coverage or range of said apparatus.

The guarantee of these paragraphs is void if equipment is altered or repaired by others than Collins.

Notice of any claimed defect must be given to Collins prior to return of any item. Such notice must give full information as to nature of defect and identification (including part number if possible) of part considered defective. Upon receipt of such notice, Collins will promptly advise respecting return of equipment. Failure to secure our advice prior to the forwarding of goods for return may cause unnecessary delay in the handling of such merchandise.

No other warranties, expressed or implied, shall be applicable to said equipment, and the foregoing shall constitute the Buyer's sole right and remedy under the agreements in this paragraph contained. In no event shall Collins have any liability for consequential damages, or for loss, damage or expense directly or indirectly arising from the use of the products, or any inability to use them either separately or in combination with other equipment or materials, or from any cause.

## HOW TO ORDER REPLACEMENT PARTS

When ordering replacement parts, you should direct your order as indicated below and furnish the following information insofar as applicable:

Address: Collins Radio Company
Sales Service Department
Cedar Rapids, Iowa

Information Needed:

(A) Quantity required
(B) Part number of item
(C) Item number (obtain from Parts List or Schematic Diagram)
(D) Type number of unit
(E) Serial number of unit
(F) Serial number of equipment

## HOW TO RETURN MATERIAL OR EQUIPMENT

If, for any reason, you should wish to return material or equipment, whether under the guarantee or otherwise, you should notify us, giving full particulars including the details listed below, insofar as applicable. Upon receipt of such notice, Collins will promptly advise you respecting the return. Failure to secure our advice prior to the forwarding of the goods or failure to provide full particulars may cause unnecessary delay in handling of your returned merchandise.

Address: Collins Radio Company
Sales Service Department
Cedar Rapids, Iowa

Information Needed:

(A) Date of delivery of equipment
(B) Date placed in service
(C) Number of hours in service
(D) Part number of item
(E) Item number (obtain from Parts List or Schematic Diagram)
(F) Type number of unit from which part is removed
(G) Serial number of unit
(H) Serial number of the complete equipment
(I) Nature of failure
(J) Cause of failure
(K) Remarks

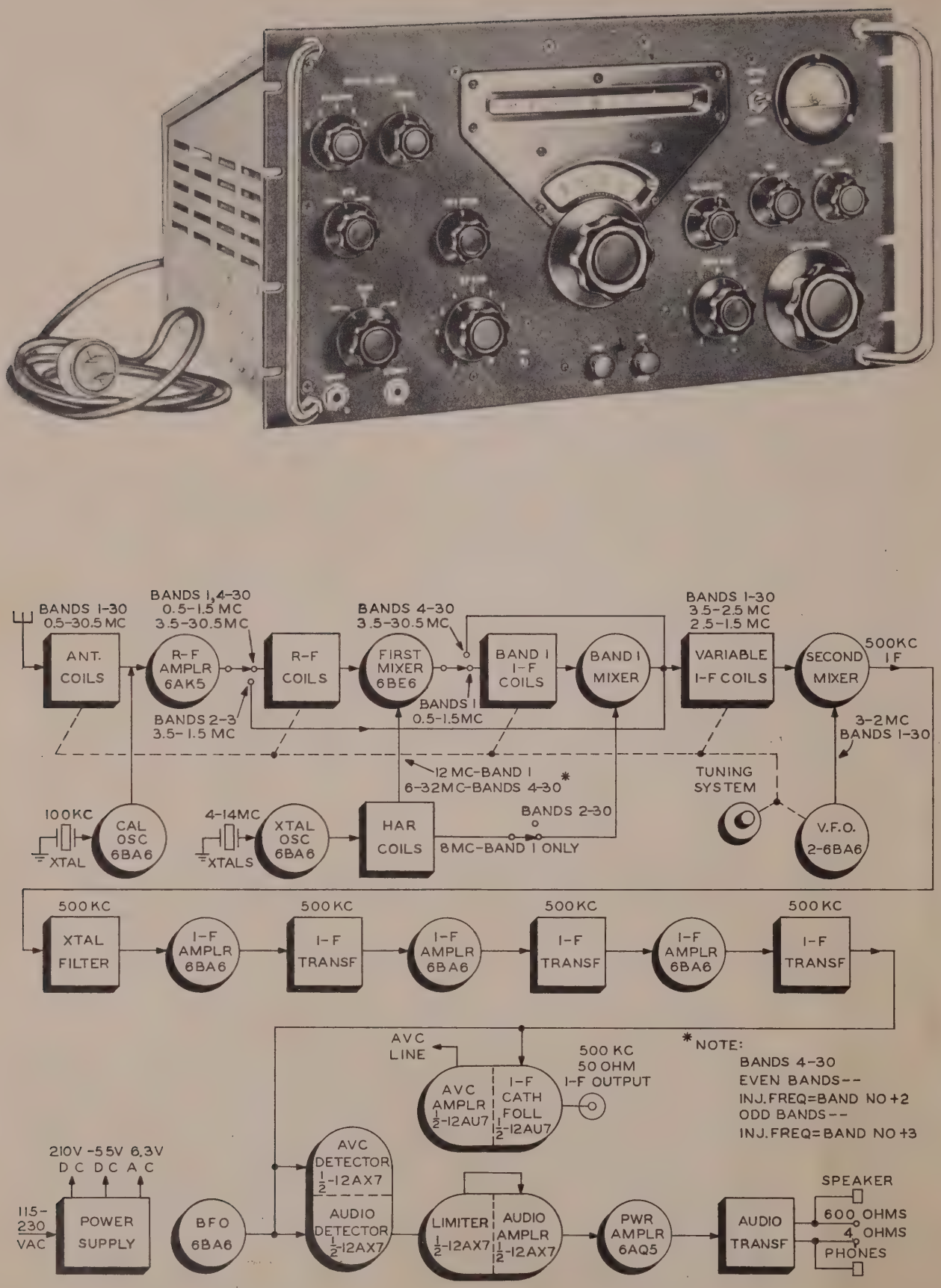



Figure 1-1. Collins 51J-3 Receiver, Front View and Block Diagram

# SECTION 1

# GENERAL DESCRIPTION

## 1.1. GENERAL.

1.1.1. PURPOSE OF BOOK. - This instruction book has been prepared to assist in the installation, operation, and maintenance of the Collins 51J-3 Radio Communications Receiver.

1.1.2. PURPOSE OF EQUIPMENT. - Collins 51J-3 Receiver is designed for communication applications which require the highest order of stability and dial accuracy. Under normal operating conditions, the receiver tunes the range of 0.5 to 30.5 mc with a normal setting error and drift of less than 1 kc at any frequency within its range. Designed primarily for amplitude-modulated and continuous-wave reception, the accuracy and stability of the receiver also make it suitable for applications where it is desired to receive or set definite frequencies without searching or frequent adjusting.

1.1.3. DESCRIPTION.

(a) MECHANICAL. - The 51J-3 receiver is constructed in a panel and shelf assembly designed for mounting in a standard rack cabinet. Overall dimensions are 19 inches width, 10-1/2 inches panel height and 13-1/2 inches depth behind the panel. Damage from dust and other foreign matter is prevented by a dust cover which fits over the top of the chassis.

The following controls are located on the front panel:

| | |
|---|---|
| R-F GAIN | CRYSTAL FILTER SELECTIVITY |
| AUDIO GAIN | CRYSTAL FILTER PHASING |
| BFO ON-OFF | OFF-STANDBY-ON |
| CALIBRATE ON-OFF | MEGACYCLE TUNING (BAND CHANGE) |
| BFO PITCH | KILOCYCLE TUNING |
| AVC ON-OFF | ZERO ADJ. |
| LIMITER ON-OFF | METER OUTPUT-INPUT |
| ANT. TRIM | CAL. (100 KC ADJUSTMENTS) |

The tuning range of .5 to 30.5 mc is divided into 30 bands, each one megacycle wide. Bands are selected by the BAND CHANGE knob and indicated by a slide-rule type dial calibrated at one-tenth megacycle (100 kc) intervals. The kilocycle tuning control covers each of these megacycle intervals with ten turns of a 100-division circular dial calibrated at one kilocycle intervals. The stability of the receiver is consistent with this finely divided calibration even at the highest frequencies.

A four-ohm headphone jack and a 600-ohm speaker jack are provided on the front panel. The antenna connector , 50-ohm i-f output

connector, break-in relay terminals and four-ohm and 600-ohm audio output terminals are provided on the rear. Also, a heavy duty a-c power cord extends from the rear of the chassis.

(b) ELECTRICAL. - Where advantageous, the 51J-3 Receiver uses single, double or triple conversion in tuning the entire frequency spectrum of .5 to 30.5 mc. Eighteen tubes, three of which are dual tubes, are employed in the receiver. With the exception of the rectifier tube, all are of the miniature type. The tuning range is divided into 30 one-megacycle bands by a system of switches and coils that are parts of the r-f amplifier and first mixer circuits. Bands are changed by moving powdered iron slugs into the coils in one megacycle steps until the coils' inductance limits are reached, then changing coils and repeating. Tuning involves positioning these slugs within the one-megacycle intervals. Injection voltage for the first mixer is obtained from either the fundamental or the harmonic output of an oscillator, the frequency of which is controlled by one of ten quartz crystals selected by the BAND CHANGE control. The kilocycle tuning control drives a vernier dial calibrated in 100 one-kilocycle divisions. This control operates through a differential mechanism to move the slugs in the coils until they cover the range between the one megacycle band change steps. Thus the BAND CHANGE control selects coils and crystals and roughly positions the tuning slugs. It also selects one of two ranges of the variable i-f channel and tunes the selected i-f coils along with the r-f coils.

Crystal frequencies for first mixer injection are so chosen that the frequency produced by the first mixer always falls in either the 1.5 to 2.5 mc or the 2.5 to 3.5 mc range of the variable i-f channel.

Exceptions to the operation just described are bands 1, 2 and 3. Band 1 (.5 to 1.5 mc) uses an intermediate mixer between the first mixer and the variable i-f coils. This mixer accepts frequencies in the range of 10.5 to 11.5 mc from the first mixer. These frequencies are produced by applying to the first mixer a 12 mc signal from the crystal oscillator. This oscillator also applies an 8 mc voltage to the band 1 mixer to produce a signal within the range of the i-f channel that tunes from 2.5 to 3.5 mc. Bands 2 and 3, which cover 1.5 to 2.5 mc and 2.5 to 3.5 mc respectively, are identical in span to each channel of the variable frequency i-f coils; thus they feed through to the second mixer without utilizing the first mixer.

Following the variable i.f. and the second mixer are the crystal filter and a three-stage fixed intermediate-frequency amplifier. Conversion to the fixed i.f. of 500 kc is accomplished by injecting into the second mixer a 2 to 3 mc signal from a Collins 70E-15 oscillator. This oscillator signal combines with either of the two variable intermediate frequencies 1.5 to 2.5 and 2.5 to 3.5 mc, to produce the difference frequency of 500 kc. The 70E-15 oscillator is tuned by the kilocycle tuning control in step with all other circuits.

Stability of the 70E-15 oscillator is assured by temperature-compensated components operating in a sealed and moisture-proof housing.

Separate rectifiers are used to produce automatic volume control and audio voltages. D-C amplification of the automatic volume control voltage is provided to obtain essentially uniform input to the detector. Audio power output is held within 3.5 db over signal input voltage ranges of five to 125,000 microvolts at the antenna terminals. A series type noise limiter clips modulation at 30 percent. This allows good reception in the presence of strong noise pulses.

## 1.2. VACUUM TUBE TABLE.

The following table lists the tubes employed in the circuits just described.

| SYMBOL DESIGNATION | TUBE TYPE | FUNCTION |
|---|---|---|
| V101 | 6AK5 | Radio-frequency amplifier |
| V102 | 6BE6 | First mixer |
| V103 | 6BE6 | Band 1 mixer |
| V104 | 6BA6 | Calibration oscillator |
| V105 | 6AK5 | High-frequency crystal oscillator |
| V106 | 6BE6 | Second mixer |
| V107 | 6BA6 | First 500 kc i-f amplifier |
| V108 | 6BA6 | Second 500 kc i-f amplifier |
| V109 | 6BA6 | Third 500 kc i-f amplifier |
| V110 | 12AX7 | Detector and A.V.C. rectifier |
| V111 | 12AU7 | A.V.C. amplifier and i-f output cathode follower |
| V112 | 12AX7 | Noise limiter and first audio amplifier |
| V113 | 6AQ5 | Audio power amplifier |
| V114 | 6BA6 | Beat frequency oscillator |
| V115 | 5V4 | Power rectifier |
| V116 | OA2 | Voltage regulator |
| V001 | 6BA6 | Variable frequency oscillator |
| V002 | 6BA6 | Oscillator isolation amplifier |

## 1.3. REFERENCE DATA

FREQUENCY RANGE: 500 kc to 30.5 mc
TYPE OF RECEPTION: AM, CW or MCW
CALIBRATION: Direct reading in megacycles and kilocycles
TUNING: Linear tuning with uniform bandspread
FREQUENCY STABILITY: Dial calibration at room temperature is within 300 cps if the nearest 100 kc calibration point is used to adjust the fiducial.

TEMPERATURE RANGE: -20°C to +60°C
SENSITIVITY: Band 1 - Less than 15 μv gives 1 watt with 10 db s/n
Bands 2 to 30 - Less than 5 μv gives 1 watt with 10 db s/n
SELECTIVITY: Total bandwidth is 5.5 to 6.5 at 6 db down and 17 to 20 kc at 60 db down. With crystal filter in, total bandwidth is 0.2 kc at 6 db down and 12 kc at 60 db down.
SPURIOUS FREQUENCY RESPONSE: Down at least 40 db
AUTOMATIC VOLUME CONTROL: Less than 3.5 db increase in audio power output with an increase in r-f signal from 5 to 125,000 μv
S METER: Meter calibrated in 20, 40, 60, 80, 100 db above AVC threshold and -10 to +6 db audio level with 6 mw as reference
NOISE LIMITER: Series type ahead of the first audio stage
AUDIO POWER OUTPUT: 1-1/2 watts at 1000 cps with less than 15% distortion
AUDIO FREQUENCY RESPONSE (overall): Not more than 3 db at 200 cps and not more than 7 db at 2500 cps
AUDIO OUTPUT IMPEDANCE: 4 and 600 ohms
I-F OUTPUT IMPEDANCE: 50 ohms
R-F INPUT IMPEDANCE: Designed to operate into a high impedance whip or single-ended antenna
POWER REQUIREMENTS: 85 watts at 115 volts 45/70 cps. Same power required when reconnected for 230 volt 45/70 cps operation
DIMENSIONS: Panel - 10-1/2 inches high, 19 inches wide, notches for standard rack mounting
WEIGHT: 43 pounds

# SECTION 2

# INSTALLATION

## 2.1. UNPACKING.

2.1.1. PROCEDURE. - Collins 51J-3 receiving equipment is packed in a number of heavy cartons. Refer to the packing slip for a list of all equipment supplied on the order. Open cartons carefully to avoid damaging the contents. Remove the packing material, and carefully lift the units out of the cartons. Search all packing material for small parcels. Extra pilot light bulbs and fuses are supplied with each equipment. Inspect each unit for loose screws and bolts. Make sure that all controls such as switches and dials work properly. All claims for damage should be filed promptly with the transportation company. If a claim is to be filed, the original packing case and material must be preserved.

## 2.2. INSTALLATION.

2.2.1. GENERAL. - The receiver should be mounted in a standard rack. Outline and mounting dimensions are given in figure 2-1. The front panel is slotted for mounting at 1-1/2, 3-3/4, 6-3/4 and 9 inches from the bottom. Panel height is 10-1/2 inches and panel width is 19 inches.

When choosing a position for the receiver, give consideration to convenience of power, antenna and ground connections, to placement of cables and to convenience in servicing the equipment. Rear panel connections are shown in figure 2-2.

2.2.2. ANTENNA CONNECTION. - Connect a cable from a high impedance whip or a single-ended antenna to antenna jack J101 on rear panel. If the receiver is to be operated near a powerful transmitter, the r-f input circuit should be protected by connecting break-in relay K101 to operate when the transmitter is radiating. Break-in relay connections are described in paragraph 2.2.5. below.

2.2.3. AUDIO OUTPUT CONNECTIONS. - Two 1/4 inch diameter audio output jacks are located on the front panel. One is designated PHONES and the other SPEAKER, their output impedances being 4 and 600 ohms respectively. An audio output terminal strip is provided on the rear panel. Terminal G is a ground connection and terminals 4 and 600 are audio outputs of 4 and 600 ohms impedance respectively. Terminal 4 is connected in parallel with the PHONES jack, and terminal 600 is connected in parallel with the SPEAKER jack. Use these output jacks and terminals as required.

2.2.4. I-F OUTPUT CONNECTION. - A 100-200 millivolt, 50 ohm, 500 kc i-f output is available at coaxial jack J104 on the rear panel.

2.2.5. REMOTE STANDBY CONNECTIONS. - Break-in relay connections are available at terminal strip E101 at the rear of the chassis. Terminals are marked 1, 2 and 3. Terminal 1 is connected to receiver ground. Terminals 2 and 3 are connected to the break-in relay coil, which is rated at 8.5 d-c volts and 135 ohms d-c resistance. During operation, terminals 2 and 3 are usually connected to a set of normally closed contacts on the carrier control relay of a transmitter in order to silence the receiver during transmission. When the break-in relay coil is energized, one pair of contacts shorts the antenna to ground; another pair, connected in series with a section of the OFF-STANDBY-ON switch, removes plate voltage from the three i-f amplifier stages. In STANDBY position, the OFF-STANDBY-ON switch also removes plate voltage from the i-f stages.

2.2.6. POWER CONNECTION. - Make power connection by using the rubber - covered cord that is permanently attached at the rear of the chassis. This cord is six feet long and is equipped with a standard a-c plug. The power source must supply 85 watts at 115 volts, 45/70 cps. If 230 volt operation is desired, reconnect transformer T108 by removing the jumpers between terminals 2 and 4 and between 1 and 3; then connect a jumper between terminals 2 and 3.

2.2.7. TUBES. - Before turning on the equipment for the first time inspect the tubes. Be sure that they are in their correct positions, and that they are firmly seated in their sockets.

2.2.8. FUSE. - The fuse is located on the rear of the chassis. It can be removed for inspection by turning the cap of the fuse post to the left and pulling straight up until the cap and fuse come free. This fuse should be the slow-blow type, with a rating of 1.5 amperes.

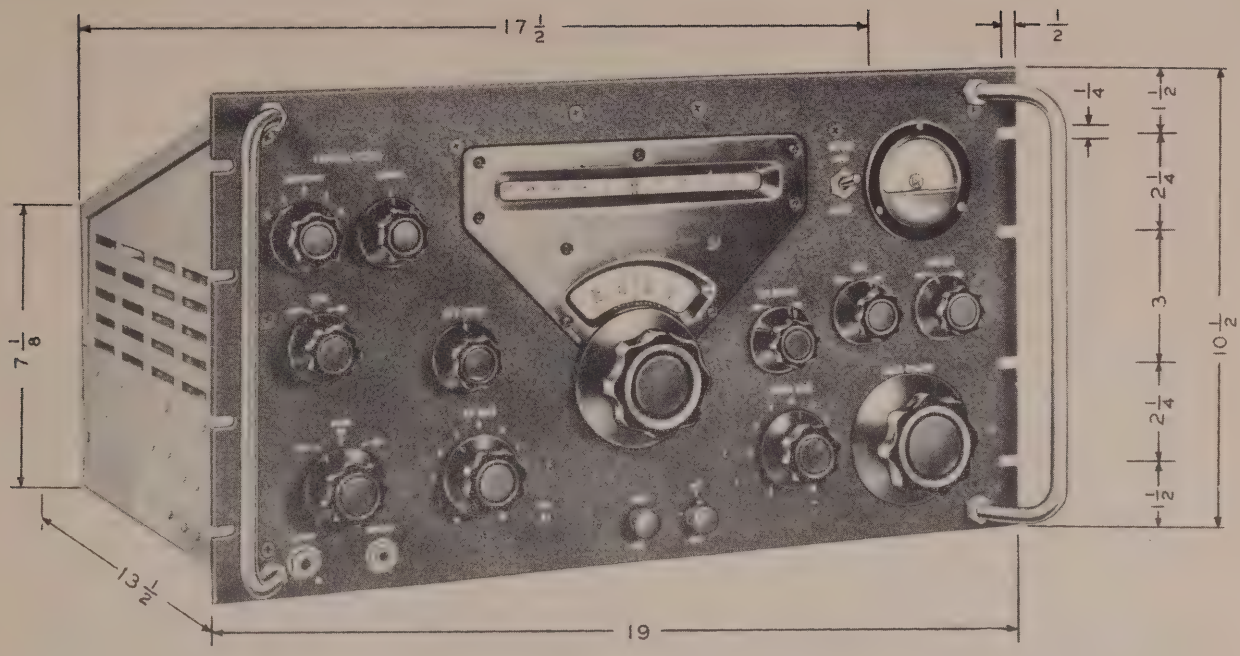



Figure 2-1. 51J-3 Mounting Dimensions

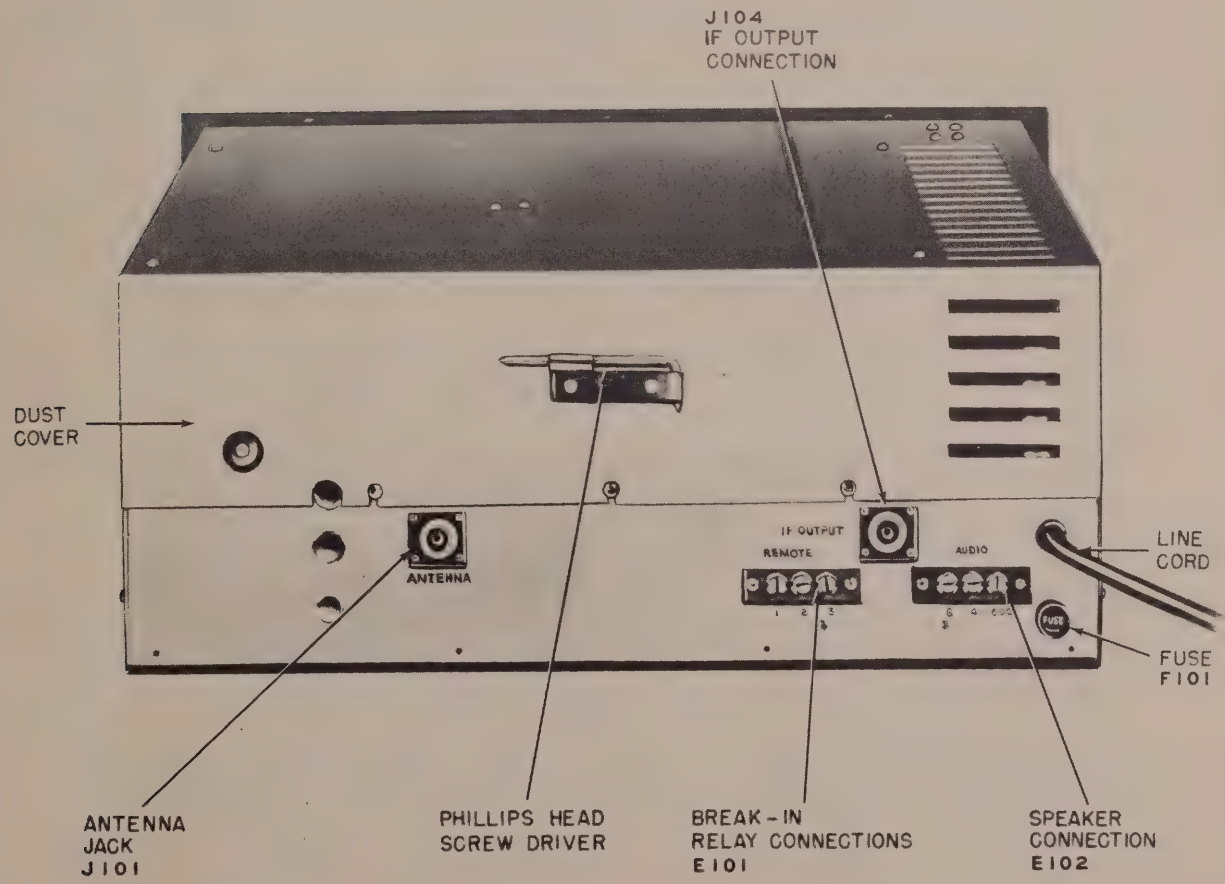



Figure 2-2. 51J-3 Rear Connections

# SECTION 3

# ADJUSTMENT AND OPERATION

## 3.1. ADJUSTMENT.

3.1.1. GENERAL. - Other than zeroing the S meter no pre-operational adjustments are necessary. Should the S meter require zeroing, turn the receiver ON, BFO OFF, AVC ON, and the 100 KC CRYSTAL OFF; then turn the RF GAIN fully clockwise. Short the antenna terminals; then turn the meter zeroing control until the S meter reads zero. Refer to figure 5-1 for location of this control.

## 3.2. OPERATION.

3.2.1. FUNCTION OF CONTROLS. - Operation of the 51J-3 receiver is exceedingly simple if the functioning of the controls is understood. The following paragraphs explain the functions of controls on the receiver's front panel.

(a) OFF-STANDBY-ON. - In the OFF position, this control opens the primary power circuit to turn the equipment completely off. In the STAND-BY position the power transformer is excited, thus producing filament voltage for all stages and plate voltage for all except the three i-f amplifier stages. In the ON position the receiver is completely operative.

(b) RF GAIN. - The RF GAIN control is located in the grid return circuit of the avc controlled tubes and is operative at all times. It varies the amount of fixed bias placed upon the grids of these tubes.

(c) AUDIO GAIN. - The AUDIO GAIN control is located in the grid circuit of the first audio amplifier and is operative at all times. It varies the amount of a-f signal applied to the grid of this tube, and thereby controls the amount of audio power produced by the receiver.

(d) BAND CHANGE. - Any one of the 30 bands may be selected by 1/2 revolution intervals by means of this knob. A stiff detent accurately positions the controlled switches on each band.

(e) MEGACYCLE. - The MEGACYCLE scale is on the slide-rule type dial. It is calibrated in ten 100 kc divisions, each of which equals one full turn of the circular KILOCYCLE dial. The 1.5 to 2.5 mc and 2.5 to 3.5 mc bands are printed in red, indicating that the red scale on the KILOCYCLE dial must be used when operating on these bands. Beginning with 3.5 mc band, the amateur bands from 3.5 to 29.7 mc are indicated by green stripes on the MEGACYCLE scale. The pointer on the MEGACYCLE dial is operated by

the KILOCYCLE control while the scale is changed by operation of the BAND CHANGE control.

(f) KILOCYCLE. - The KILOCYCLE dial is the main tuning control on the 51J-3 receiver. Each division on its circular face represents one kilocycle. One full turn of the dial tunes the receiver through 100 kilocycles, or one division of the MEGACYCLE scale. To read the tuning dials, merely combine the figures of the MEGACYCLE dial with those of the KILOCYCLE dial, thus arriving at the frequency in kilocycles. For example, a reading of 14.1 on the MEGACYCLE dial and of 78 of the KILOCYCLE dial indicates a frequency of 14178 kc. The KILOCYCLE scale for the 1.5 to 2.5 and 2.5 to 3.5 mc bands is in reverse order to the scale for the rest of the bands, and is printed in red similar to corresponding scales on the MEGACYCLE dial.

(g) ZERO ADJ. - The ZERO ADJ moves the indicator line on the KILOCYCLE control a few divisions in either direction for calibration purposes. The receiver may be calibrated against either any receivable station whose frequency is known or the internal calibration oscillator. This oscillator emits a harmonic every 100 kc in the tuning spectrum. An example of how the receiver may be calibrated using this oscillator follows. If the desired signal is about 14100 kc, turn the 100 KC CRYSTAL ON and the BFO ON. Next, using the KILOCYCLE knob, tune to zero beat with the 100 kc marker at 14100 kc. Then move the ZERO ADJ control until the hair line is exactly on 14100 kc. The dial reading in this region is now very accurate, and the receiver may be set within a few hundred cycles of the desired frequency.

NOTE

WHEN READING THE FREQUENCY OF AN INCOMING SIGNAL, THE BFO PITCH CONTROL MUST BE LEFT IN THE SAME POSITION AS IT WAS WHEN THE RECEIVER WAS CALIBRATED.

A ten division scale (five divisions either side of center) is engraved on the lower edge of the escutcheon opening for the KILOCYCLE dial, and is used to log the calibrated position of the hair line on the various bands in lieu of recalibrating each time the band is used.

(h) METER INPUT-OUTPUT. - The METER switch is a momentary spring-return type toggle switch. In the normal or INPUT position the meter is connected as an S meter. In the OUTPUT position, the meter is connected in the audio output circuit as a db meter.

(i) BFO OFF-ON. - In the ON position this control turns ON the beat frequency oscillator for CW reception. In the OFF position, it grounds the

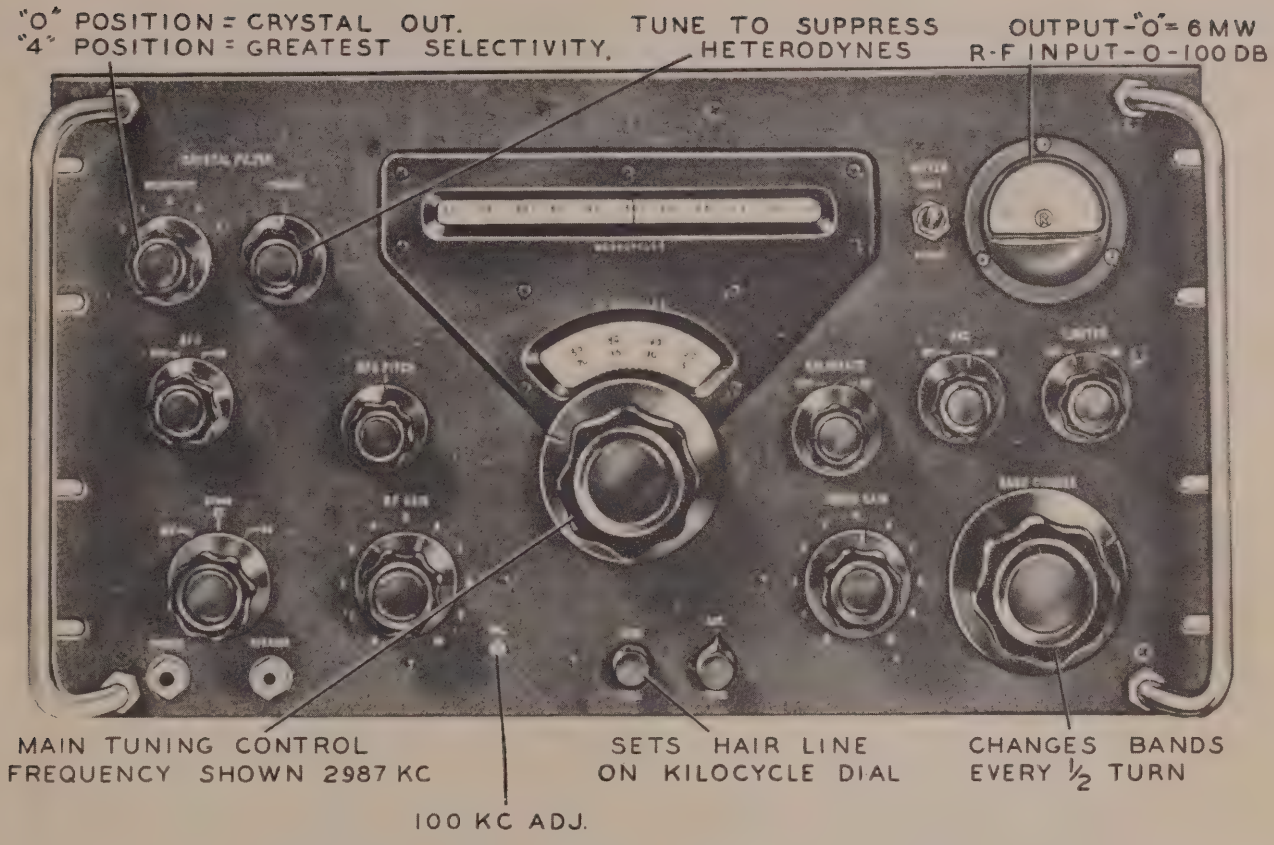



Figure 3-1. 51J-3 Operating Controls

screen grid of the BFO tube.

(j) BFO PITCH. - The BFO pitch control varies the frequency of the beat frequency oscillator to change the pitch of the audio tone which is produced by combining the BFO signal with the incoming signal. A range of about ± 3 kc minimum can be obtained with this control.

(k) CALIBRATE OFF-ON. - This switch is in the cathode circuit of 100 kc crystal oscillator tube V104 and turns the 100 kc oscillator ON or OFF. For an explanation of how to use the oscillator, see paragraph (g) above.

(l) AVC OFF-ON. - This switch turns AVC ON or OFF. In most cases AVC should be ON for both AM and CW reception, but may be turned OFF for CW reception if desired.

(m) LIMITER OFF-ON. - The noise limiter is useful for both AM and CW reception. When noise is not a problem, turn the LIMITER to OFF, as the distortion will be less in this position. When noise of the impulse type is being received, turn the LIMITER to ON. Adjustment of RF and AF gain controls is necessary for best CW noise limiting.

(n) CRYSTAL FILTER.

SELECTIVITY. - In position 0 of this control, the crystal filter is not used and selectivity is determined by the receiver's tuned circuits alone. In positions 1 through 4, the crystal filter is in the circuit, the selectivity being increased as position 4 is approached. Position 4 gives a bandwidth of about 200 cps at 6 db down.

PHASING. - The PHASING control is used to reject unwanted heterodynes. When positioned on the panel mark, the control is properly set for crystal phasing with no rejection notch. If a high frequency heterodyne is interfering with reception, move the control back and forth near the panel mark until the heterodyne is attenuated. If the heterodyne is of lower frequency, move the control farther to left or right of the panel mark. This control will attenuate heterodynes ranging from 1 to 3 kc.

(o) METER. - The tuning meter is calibrated in 20, 40, 60, 80 and 100 db above AVC threshold when reading r-f input. When reading audio output, the meter is calibrated from -10 to +6 db, zero reference being 6 milliwatts into a 500 ohm load.

(p) CAL. - If supreme accuracy is desired, the frequency of the 100 kc oscillator should be checked against WWV or some other station whose frequency is known to be extremely accurate. This oscillator frequency may be varied through small limits by turning the CAL control with a screw driver. Additional range can be obtained by turning C169, located just behind the 100 kc crystal.

# SECTION 4

# CIRCUIT DESCRIPTION

## 4.1. MECHANICAL DESCRIPTION

4.1.1. BAND CHANGE. - Collins 51J-3 Receiver covers the frequency range of 0.5 to 30.5 mc in 30 bands: 0.5 to 1.5, 1.5 to 2.5, and so on up to 30.5 mc. Each band is one megacycle wide. Circuits affected by band changes are the r-f amplifier grid, first, second, and third mixer grids, crystal selector, and crystal harmonic tuning circuits. The third mixer is switched in only on band 1 (.5 to 1.5 mc). See figure 4-1.

Operations involved in the changing of bands consist of selecting the proper coils in these circuits by means of tap switches and changing the position of the r-f amplifier and first mixer slug tables. All stages are permeability tuned by powdered iron slugs. The r-f amplifier and first mixer slug tables change position a full megacycle in tuning each time a band is changed. This is true of all three slug tables, which tune L101 through L113. However, the tap switches select the proper set of coils for the frequency desired.

Slug tables are driven from two sources: the main tuning knob and the BAND CHANGE knob. These two driving sources are connected to the slug tables through a differential gear mechanism. This is necessary since the coils for bands 4 to 7, 8 to 15, and 16 to 30 cover these tuning ranges with one complete excursion of the tuning slugs. For instance, the band 4 to 7 slug table tunes its associated coils through four megacycles; in one megacycle jumps when operated by the BAND CHANGE knob, and in complete coverage in between when operated by the tuning knob. An interesting feature of the differential gearing is its ability to combine the movements of the two driving sources so that the slug table is moved exactly one megacycle in each band change. The other slug tables operate similarly to the 4 to 7 table, except that the band 8 to 15 table tunes its associated coils through 8 mc, and the band 16 to 30 table tunes its associated coils through 15 mc. These three slug tables are moved simultaneously by means of separate cams.

Switch sections of the band switch are ganged with the three slug tables through an over-travel coupler. This overtravel coupler drops the band switch at band 16 and continues to operate one position for each band as usual. Refer to figure 4-2. This mechanical diagram shows the gears and connecting shafts associated with band change and tuning. Shafts associated with changing bands are C, D, G, H, I, K, and the overtravel shaft. On band 1 radio frequency coils L101 and L110 are switched by means of the BAND CHANGE knob through the overtravel shaft and shaft G.

On bands 2 and 3, the r-f coils are selected by the BAND CHANGE knob through the overtravel shaft and shafts G and K, variable i-f coils L116 through L119 being used as additional r-f coils on these bands. On bands 4 to 7, the coils are selected by the BAND CHANGE knob through the overtravel shaft and shaft G, and the position of the slug table is changed through shafts A, B, C, and D. On these bands the same coils are used for each band. Band change is accomplished by moving the tuning slug in the coil an amount equal to one megacycle in frequency. The slug moves in the coil 0.250 inches for a one megacycle change. On bands 8 to 15, the r-f coils are changed by the overtravel shaft and shaft G, and the position of the slug table is changed one megacycle per band through shafts A, B, C and D. The movement of the slug table for a one megacycle change is 0.125 inches. On bands 16 to 30, the r-f coils are switched through the overtravel shaft and shaft G to position 16 where the band switch remains for bands 16 to 30 while the overtravel coupler allows shaft G to rotate through to the thirtieth band. The slugs in the r-f coils are driven through shafts A, B, C, and D. The slugs travel 0.0625 inches during band change. During operation on any band between 4 and 30 the variable i-f channel is alternated from one variable i-f to the other by shafts G and K. Crystals are selected by operation of the BAND CHANGE knob through the 15-position Geneva system and shafts G, H, and I.

4.1.2. TUNING. - All r-f, mixer and variable i-f coils, as well as the variable frequency oscillator coil, are permeability-tuned by powdered iron cores. While tuning, these slugs move in and out of the coils at a rate determined by a cam or by a lead screw. Four slug racks or tables are used in the 51J-3 receiver to perform the function of tuning the r-f, mixer and variable i-f stages. The group of three slug tables in the rear portion of the chassis tunes the r-f and first mixer stages when the receiver is operating in the 3.5 to 30.5 mc frequency range ( bands 4 to 30), The fourth slug table, located at the right hand edge of the receiver, tunes the r-f stage, the first mixer grid, the third mixer grid and the variable i-f coils when receiving in the range 0.5 to 1.5 mc. It tunes the r-f stage and variable i-f coils L116 and L118 when receiving in the range 1.5 to 2.5 and 2.5 to 3.5 mc. When receiving in the range 3.5 to 30.5 mc, this slug table tunes only the variable i-f coils L116 and L118. During tuning, positions of the slug tables are varied by a system of gears and cams; see figure 4-2. On band 1 (0.5 to 1.5 mc) coils L101 and L110 are tuned through this frequency range by the main tuning knob through shafts A, B, C and E. On bands 2 and 3 (2.5 to 1.5 and 3.5 to 2.5), tuning is done by the main tuning knob through the same shafts -- A, B, C and E. On band 4 to 7, the main tuning knob tunes coils L104, L107 and L111 over one-fourth of their tuning range through shafts A, B, C and D and the differential shafts. The BAND CHANGE knob moves this same rack through shafts G, C, D, and the differential in four steps. Each step is equal to one-fourth of the coils' tuning range and the shafts are positioned by means of the detent. Thus L104, L107, and L111 are tuned in one megacycle steps by the BAND CHANGE knob, and between these steps are tuned by the main tuning

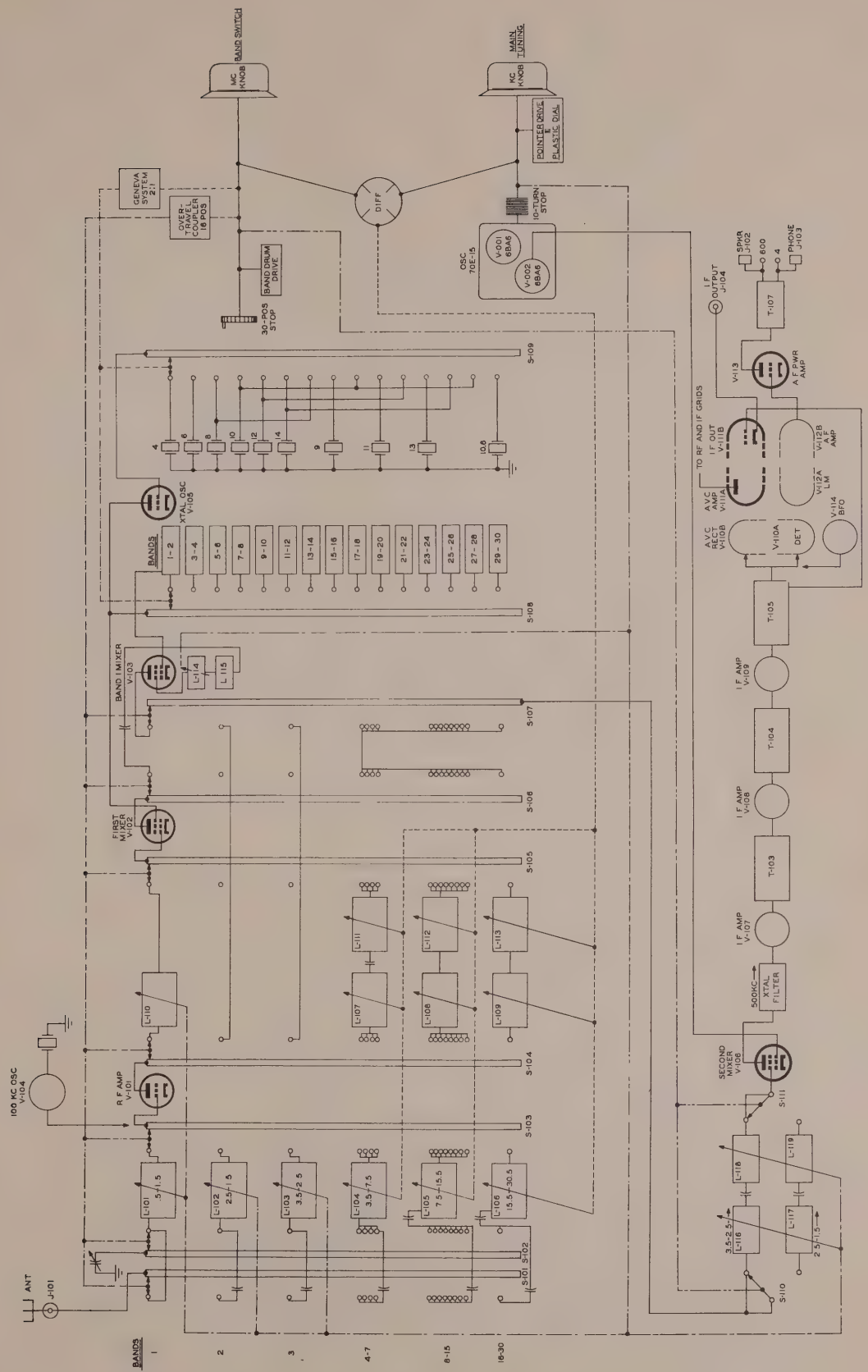



Figure 4-1. 51J-3 Band Change and Tuning System, Block Diagram

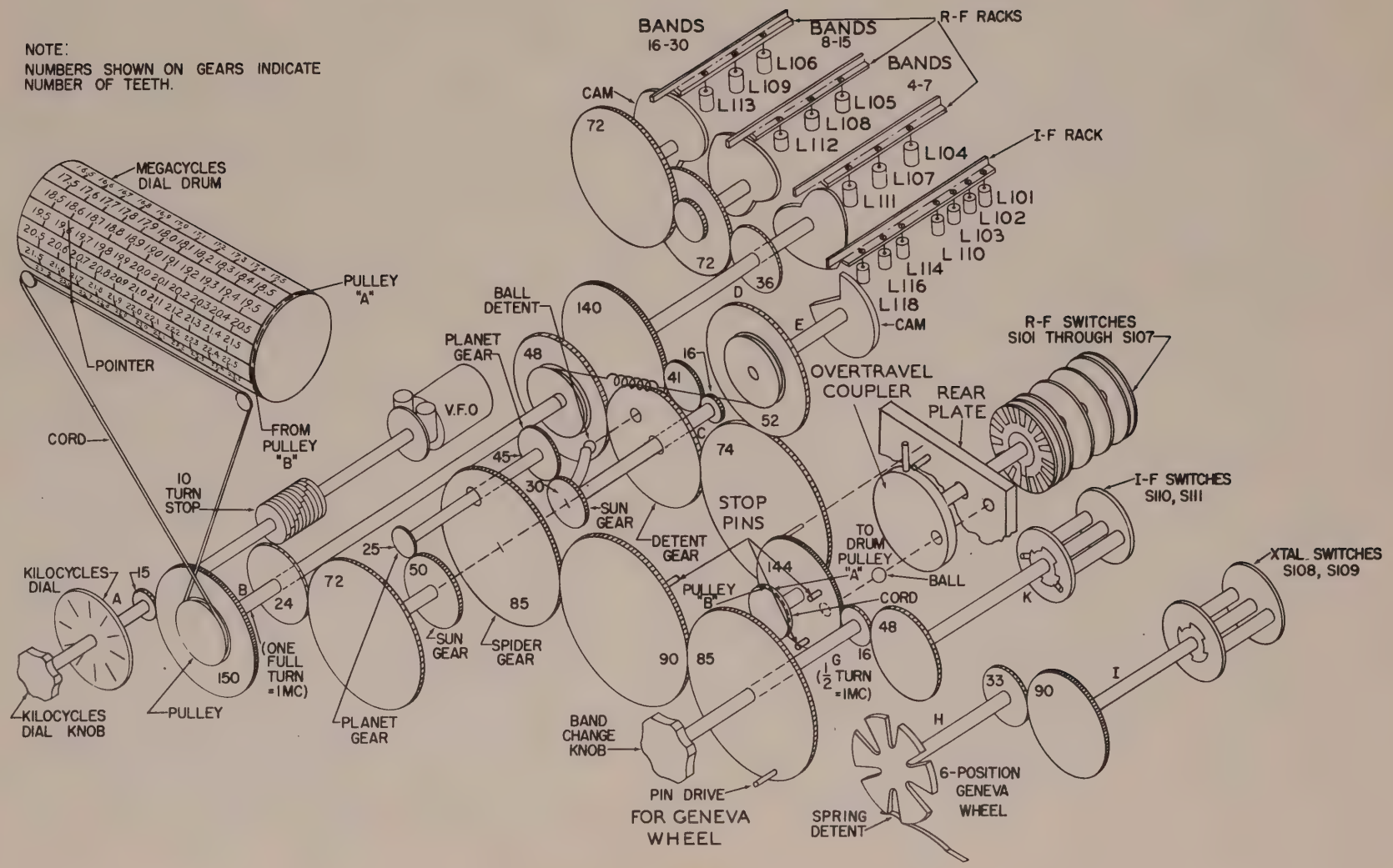



Figure 4-2. 51J-3 Mechanical Block Diagram

knob. On bands 8 to 15, coils L105, L108, and L112, are tuned through shafts A, B, C, D and the differential. Bands 16 to 30 are also tuned through shafts A, B, C, D and the differential. Each of the two variable frequency i-f channels covers one megacycle range and is tuned by means of the main tuning knob through shafts A, B and E. The proper channel is selected by the BAND CHANGE knob through shafts G and K.

4.1.3. FREQUENCY INDICATION. - The band on which the receiver is operating is indicated on the drum dial that is rotated by the BAND CHANGE knob through shaft G. The 100 kc divisions are indicated by a pointer on the slide rule dial. This pointer is driven from the main tuning knob through shaft A. Kilocycle divisions are indicated by the plastic dial mounted on shaft A. Two scales are necessary on this dial because bands 2 and 3 run in opposite directions. Mechanical stops are mounted on the control shafts to prevent overtravel.

## 4.2. ELECTRICAL DESCRIPTION.

4.2.1. GENERAL. - Collins 51J-3 Receiver is a complete coverage superheterodyne receiver capable of AM and CW reception in the frequency range of 0.5 to 30.5 megacycles. The set covers the tuning range in 30 bands, each band one megacycle wide. Various portions of the tuning spectrum use single, dual and triple conversion. Three stages of intermediate-frequency amplification and a crystal filter produce the desired degree of selectivity. The receiver also features a low impedance AVC, a good noise limiter, two stages of audio amplification and a 100 kc frequency spotter or calibrator.

The receiver employs dual conversion on most bands and single or triple on others in order to obtain full coverage economically with a minimum of image and other spurious responses on all bands. Band 1, 0.5 to 1.5 mc uses triple conversion, bands 2 and 3, 1.5 to 3.5 mc, use single conversion, and bands 4 to 30, 3.5 to 30.5 mc, use dual conversion. Each band is numbered on the band's center frequency. For instance, band 1 covers 0.5 to 1.5 mc, band 2 covers 1.5 to 2.5 mc, and so on.

On band 1, where triple conversion is necessary, an intermediate mixer is employed between the first and second mixers used in the regular dual conversion scheme. The 0.5 to 1.5 mc carrier on band 1 is fed to the first mixer where it is beat against a 12 mc signal from the h-f crystal oscillator to produce an 11.5 to 10.5 mc signal. This signal is beat against an 8 mc signal in the intermediate mixer to produce the variable i.f. of 3.5 to 2.5 mc. The variable i.f. is then combined with the 3 to 2 mc variable oscillator output to produce the fixed 500-kc i.f. On bands 2 and 3, the 1.5 to 3.5 mc carrier is fed directly to the second mixer where it is combined with the same variable oscillator output to produce the 500-kc fixed i.f. On bands 4 to 30 the regular dual conversion scheme is employed. On the even numbered bands the signal frequency is beat against the high frequency oscillator output to produce a variable

i.f. of 2.5 to 1.5 mc. On the odd numbered bands a variable i.f. of 3.5 to 2.5 mc is produced. The variable i.f. is then combined in the second mixer with the v.f.o. output to produce the 500-kc fixed i.f. The detailed operation of the various receiver circuits is outlined in the following paragraphs.

4.2.2. RADIO FREQUENCY AMPLIFICATION. - Refer to the block diagram, figure 4-1. One stage of radio frequency amplification is (V101) used on all bands. A type 6AK5 miniature r-f pentode is employed in this stage because of its low noise and good sensitivity characteristics at high frequencies. The antenna is capacitively-coupled to the grid of the r-f stage on all bands. The r-f coils for bands 1, 2, and 3 are mounted in the variable i-f group and are tuned by slugs mounted on the variable i-f slug table which is at the extreme right hand edge of the receiver as viewed from the front. The coils for bands 4 to 30 are clustered at the rear of the chassis and are tuned by slugs mounted on the three r-f and mixer slug tables.

When operating in the American broadcast band (band 1), the plate circuit of the r-f tube is impedance-coupled to the grid circuit of the first mixer tube by resistor R105, capacitor C117, and inductor L110. On bands 2 and 3 the plate of r-f amplifier tube V101 is switched directly to primary coils of the variable i-f tuner where additional selectivity is obtained, single conversion being used on these two bands. When operated on bands 4 to 30, the plate circuit of the r-f stage is tuned and capacitively-coupled to the tuned circuit in the grid of the first mixer stage.

4.2.3. MIXER STAGES.

(a) FIRST MIXER. - The first mixer stage consists of a type 6BE6 miniature converter tube. This stage is used on band 1 and bands 4 to 30 (0.5 to 1.5 mc and 3.5 to 30.5 mc) but not on bands 2 and 3 (2.5 to 1.5 and 3.5 to 2.5). In the range .5 to 1.5, the grid circuit of this tube is tuned by L110, C118 and C119. In the range of 3.5 to 30.5, the grid circuit is capacitively-coupled to the tuned plate circuit of r-f stage V101. The plate circuit of first mixer tube V112 is tuned to either 2.5 to 1.5 mc or 3.5 to 2.5 mc, depending on which band between 4 and 30 is being operated. However, this circuit is tuned to the 11.5 to 10.5 mc spectrum when the receiver is tuned to the American broadcast band (band 1). On bands 13 to 30, the heterodyning signal for the first mixer is obtained from crystal oscillator stage V105 through the proper crystal oscillator plate tuning coils. On bands 4 to 12 no plate tuning coils are used. On bands 4 to 30 the output of the first mixer is always between 1.5 to 2.5 mc or 2.5 to 3.5 mc. When used on band 1, the first mixer is fed a 12 mc heterodyning signal from oscillator tube V105. The output of the first mixer is 11.5 to 10.5 mc which, when mixed in the third mixer with an 8 mc signal from the crystal oscillator, produces a 3.5 to 2.5 mc

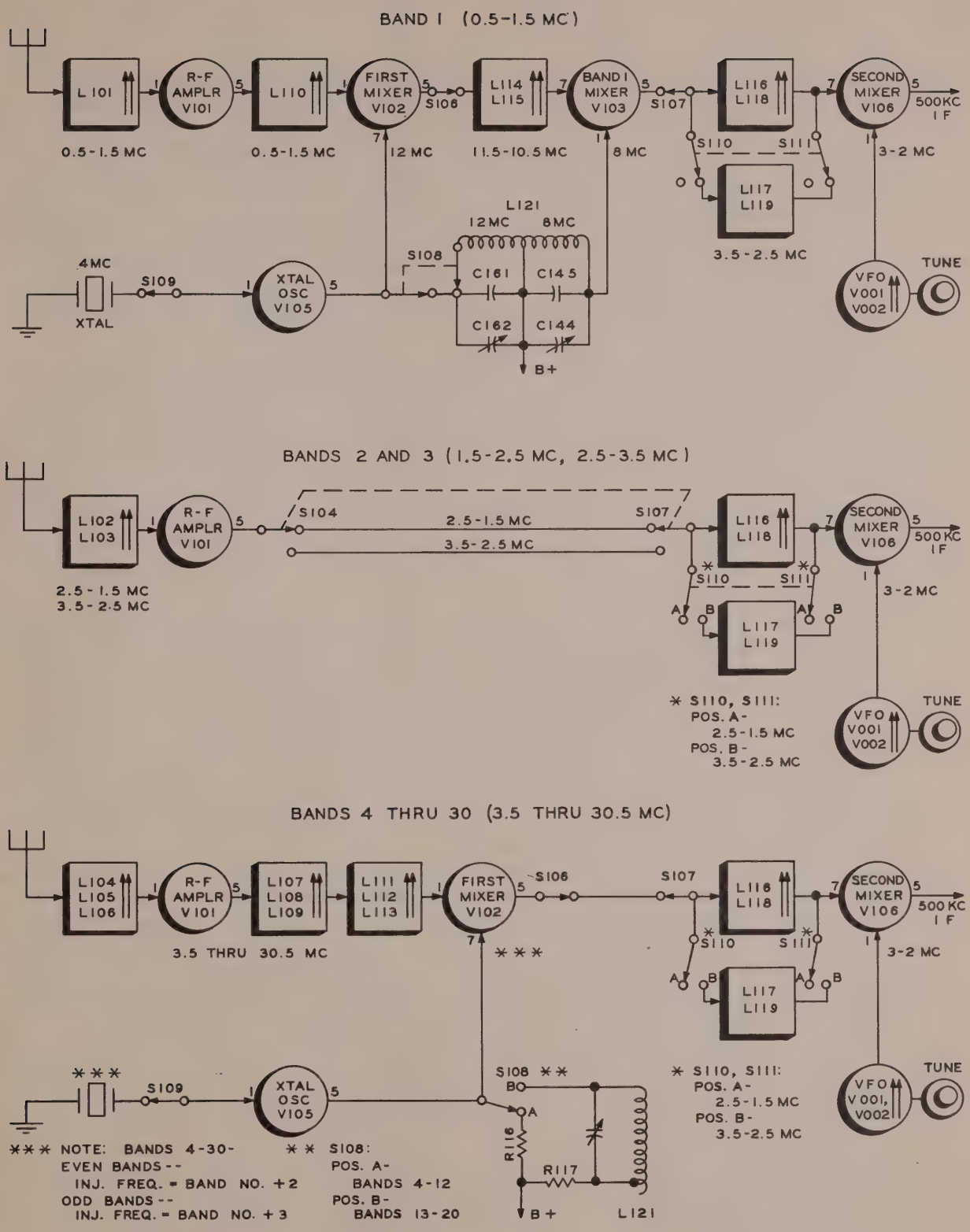



Figure 4-3. 51J-3 Frequency Conversion Circuits

voltage for presentation to the variable i-f coils. Output of the first mixer is switched from the variable i-f coils to the grid of the third mixer by means of switch pies S106 and S107.

(b) SECOND MIXER STAGE. - The second mixer stage, V106, also employs a 6BE6 miniature converter tube. Input to this stage is always either 3.5 to 2.5 mc or 2.5 to 1.5 mc from the variable i-f coils L116/L118 and L117/L119. The 3 to 2 mc output of the permeability tuned oscillator is fed into the second mixer tube at grid number one to heterodyne against the input signal to produce a 500 kc intermediate frequency. This mixer stage is always used for all bands.

(c) THIRD MIXER STAGE. - The third, or band 1, mixer stage is used only when receiving on band 1. A type 6BE6 miniature converter tube is used in this application also. Grid number 3 of this tube is excited by a 11.5 to 10.5 mc signal from the plate circuit of first mixer tube V101, and grid number one is excited by a heterodyning 8 mc signal from the crystal oscillator. The output of the third mixer is then 3.5 to 2.5 mc, which is then fed to the grid of the second mixer through the variable i-f coils. This, of course, takes place only when receiving on band 1 as this stage is not used on the other bands.

4.2.4. HIGH FREQUENCY OSCILLATOR. - The high frequency oscillator uses a 6AK5 miniature pentode tube in a modified Colpitts oscillator circuit. No tuned coils are needed to make the circuit oscillate because in-phase feedback voltage is produced across r-f choke L120. Ten quartz crystals are used to control the frequency of the oscillator output for the various bands. At the minimum, each crystal is used for two adjacent bands, i.e. 1-2, 3-4, 5-6 and so on. The harmonics of certain crystals are used also for other higher bands. For instance, the 8 mc crystal used for bands 5 and 6 is also used for bands 13 and 14 by utilizing its second harmonic at 16 mc. In those instances where harmonic operation is used, a tuned circuit picks off the correct harmonic. This tuned circuit is in the plate circuit of oscillator tube V105 and consists of the primary coil of L121 and a number of tuning capacitors. The latter are selected for the proper band by switch pie S108. The secondary of coil L121 is tuned to 8 mc and is used when operating on band 1 to furnish the third mixer with an eight mc heterodyning signal (second harmonic of the 4 mc crystal). At the same time, the primary of L121 is tuned to 12 mc (third harmonic of the 4 mc crystal) to furnish the first mixer with the required 12 mc heterodyning signal. A list of the crystals and the bands upon which they function is outlined on the following page:

CIRCUIT FREQUENCY

| CRYSTAL FREQUENCY | RECEIVER FREQUENCY | BAND | INJECTION FREQUENCY |
|---|---|---|---|
| 4 | 0.5 to 1.5 | 1 | 8 and 12 |
| | 1.5 to 2.5 | 2 | None |
| | 2.5 to 3.5 | 3 | None |
| 6 | 3.5 to 4.5 | 4 | 6 |
| 8 | 4.5 to 5.5 | 5 | 8 |
| | 5.5 to 6.5 | 6 | 8 |
| | 12.5 to 13.5 | 13 | 16 |
| | 13.5 to 14.5 | 14 | 16 |
| 10 | 6.5 to 7.5 | 7 | 10 |
| | 7.5 to 8.5 | 8 | 10 |
| | 16.5 to 17.5 | 17 | 20 |
| | 17.5 to 18.5 | 18 | 20 |
| | 26.5 to 27.5 | 27 | 30 |
| | 27.5 to 28.5 | 28 | 30 |
| 12 | 8.5 to 9.5 | 9 | 12 |
| | 9.5 to 10.5 | 10 | 12 |
| | 20.5 to 21.5 | 21 | 24 |
| | 21.5 to 22.5 | 22 | 24 |
| 14 | 10.5 to 11.5 | 11 | 14 |
| | 11.5 to 12.5 | 12 | 14 |
| | 24.5 to 25.5 | 25 | 28 |
| | 25.5 to 26.5 | 26 | 28 |
| 9 | 14.5 to 15.5 | 15 | 18 |
| | 15.5 to 16.5 | 16 | 18 |
| 11 | 18.5 to 19.5 | 19 | 22 |
| | 19.5 to 20.5 | 20 | 22 |
| 13 | 22.5 to 23.5 | 23 | 26 |
| | 23.5 to 24.5 | 24 | 26 |
| 10.67 | 28.5 to 29.5 | 29 | 32 |
| | 29.5 to 30.5 | 30 | 32 |

4.2.5. VARIABLE INTERMEDIATE FREQUENCY. - The variable intermediate frequency section consists of two channels, one for a frequency 2.5 to 1.5 mc and the other for 3.5 to 2.5 mc. The 2.5 to 1.5 mc i-f is used on the even numbered bands which employ double conversion, and the 3.5 to 2.5 mc i-f is used on the odd numbered bands which employ double conversion. The 2.5 to 1.5 mc i-f is also used on band 2 as an additional tuned r-f circuit. The 3.5 to 2.5 variable i-f is used on band 3 as an additional tuned r-f circuit and on band 1, in the usual application, as a variable i-f for the odd numbered bands. Using two variable i-f channels in this manner cuts in half the number of crystals needed by the high frequency oscillator, since each crystal's

fundamental frequency or useful harmonic is used for two bands. Inductors L116 and L118 form the lower frequency i-f coils (2.5 to 1.5) and are the coils in which the tuning slug travels. The 3.5 to 2.5 mc i-f is obtained by shunting L116 across L117, and L118 across L119 to lower the inductances of L116 and L118. Switch sections S110 and S111 alternately switch the shunting coils in and out as the BAND CHANGE knob is rotated. The variable i-f coils are in the grid circuit of the second mixer stage.

4.2.6. VARIABLE FREQUENCY OSCILLATOR. - The receiver circuits described so far have the function of receiving the spectrum in 1 megacycle bands that are presented to the grid of the second mixer. The scheme for obtaining high stability is completed by a method of heterodyning the signals to a lower, fixed intermediate frequency. In this application, a highly stabilized 3 to 2 mc permeability tuned oscillator, Model 70E-15, is employed to heterodyne against the 2.5 to 1.5 and the 3.5 to 2.5 mc output of the variable frequency i-f. The resulting 500 kc signal is amplified by the 500 kc i-f amplifier.

The coil in the oscillator is cam wound to produce extremely linear frequency change with linear movement of the tuning slug. The circuit is temperature-compensated and the components are sealed against changes in humidity. Ten turns of the oscillator lead screw produce a linear frequency change of one megacycle. The inductance of the oscillator coil is trimmed by an iron core series inductor, the value of which is adjusted at the factory and sealed.

A type 6BA6 is used for isolation purposes following the oscillator tube. This isolation tube, V002, is an integral part of the oscillator.

4.2.7. CRYSTAL FILTER. - Selectivity of the 51J-3 receiver is improved greatly by use of a crystal filter in the 500-kc i-f channel. The crystal filter circuit consists primarily of 500-kc i-f input transformer T101, a 500-kc crystal, and a high impedance tuned circuit T102, connected as shown in figure 7-7. When SELECTIVITY switch S114 is in position 0 the crystal is shorted and T101 is connected directly to T102. Thus, there is no crystal filter action when S114 is in position 0; selectivity is determined by the receiver's tuned circuits alone. When S114 is in any other position, crystal filter action takes place--position 4 giving the greatest selectivity.

To analyze the operation of this circuit consider only the loop containing T101 secondary, crystal Y112, and tuned circuit T102. Assume that S114 is in position 1. The secondary of T101 is a low impedance coil with a grounded center tap. The primary of T101 is tuned to 500 kc. Consider crystal Y112 in series with T102 as a voltage divider, grid voltage to V107 being taken from the point between Y112 and T102. For an i.f. of

exactly 500 kc, impedance of the crystal is very low--of the order of 2000 to 4000 ohms, and the impedance of T102 is of the order of 100,000 ohms. Thus, at 500 kc practically all the voltage appearing across T101 secondary is fed to the grid of V107.

For frequencies a few kilocycles further away from 500 the impedance of the crystal increases greatly. When the crystal impedance equals that of T102, only one-half the voltage on T101 secondary appears on the grid of V107. As the crystal impedance becomes still greater, the voltage appearing on V107 grid decreases. This results in a narrower i-f response curve, or in greater selectivity, than that obtained without crystal filtering. Switching S114 to positions 2,3, or 4 merely shunts T102 with resistance, which effectively lowers the impedance of T102 for those positions. This results in a more rapid decrease in V107 grid voltage as the i.f. deviates to either side of 500 kc. Hence, as the effective impedance of T102 lowers, selectivity increases. In the sharpest position the bandwidth at 6 db down is from 200 to 300 cps.

The primary purpose of PHASING capacitor C188 is to produce a controllable rejection notch in the i-f response curve so that unwanted heterodynes may be tuned out. The section of C188 connected to the bottom end of T101 secondary provides a capacitive path around the crystal that balances out the shunt capacitance of the crystal in its holder and external capacitor C187. Varying C188 either side of the balance point varies the anti-resonant frequency of the crystal circuit within 3 kc either side of 500. Since the impedance of the crystal circuit at anti-resonance is extremely high, the crystal filter rejects signals at the anti-resonant frequency.

In order to avoid detuning tuned circuit T102 when varying C188, a second section of C188 is shunted across T102. Since C188 has a split stator and a single rotor, the total shunt capacitance across T102 remains practically constant as the setting of C188 is varied.

4.2.8. SECOND INTERMEDIATE FREQUENCY. - The second intermediate frequency is fixed-tuned to 500 kc. It consists of three stages and employs 6BA6 tubes in all three stages. Input tube V107 is excited by the crystal filter output coil T102. Permeability-tuned transformers, with output taps taken off the secondary coils near the ground end, are used to produce the desired i-f selectivity. All three stages are supplied with AVC voltage.

4.2.9. DETECTOR. - The detector in the 51J-3 receiver consists of one half of a 12AX7 dual triode tube, V110 (pin numbers 6, 7, and 8). The tube is used as a diode, with rectification taking place between the plate and cathode, the grid being connected to the plate. R150 and R151 serve as load resistors for the detector while C202 provides r-f filtering.

4.2.10. NOISE LIMITER. - A series type noise limiter is used in the 51J-3 reciever. This limiter employs one-half (pins 1, 2 and 3) of a type 12AX7 dual triode tube, V112. Refer to figure 4-4. Due to a-c loading of the

second detector, heavy noise impulses are automatically clipped from the positive audio peaks in the detector. The noise appearing on the negative side of the audio cycle is clipped by the noise limiter. In operation, a negative voltage produced by rectification of the carrier is developed across capacitor C205C. This voltage cannot change rapidly due to the value of C210 and R152 through which C205C charged. This negative potential is placed upon the cathode of the noise limiter tube through R153. The cathode is then negative in respect to the plate of the noise limiter tube, due to voltage divider action of R150 and R151,and current flows. This current is modulated by the audio which then appears on the noise limiter cathode to which the grid of the audio amplifier section of V112 is connected. The noise limiter diode will conduct as long as the cathode is negative in respect to the plate. However, should a heavy noise impulse be received, the plate would be driven negative faster than the cathode could follow due to the time constant of R152 and C210. If the plate is driven more negative than the cathode, the tube will cease to conduct and no audio will reach the grid of the following audio tube. The audio cannot reach the cathode of the limiter tube directly from the bottom of the detector transformer because of the filtering action of R152 andC205C. The value of modulation at which the limiter clips can be adjusted by changing the value of some of the components in the circuit. In this receiver, limiting starts between 50% and 85% modulation. Switch S116 bypasses the signal around the noise limiter when receiving conditions do not require its use.

4.2.11. AUTOMATIC VOLUME CONTROL. - The problem of blocking that is created by strong signals or heavy static is eliminated by use of an amplified AVC system and a low impedance AVC line. Refer to figure 4-5. The second triode section of V110 is used as an AVC rectifier to produce control voltage for the AVC amplifier which uses one half of dual triode V111. The AVC voltage that is applied to grids of the controlled tubes is produced when plate current flowing through one-half of AVC amplifier tube V111 causes a voltage drop across resistor R146. Plate voltage for the amplifier half of V111 is obtained from the voltage drop across resistors R164, R165 and R166, which are in series with the center tap of the power transformer to ground. However, V111 will not draw plate current when there is no signal input to the receiver because of approximately 11 volts of bias that is placed upon its grid by the voltage drop through R164. This bias voltage for V111 is taken from the end of R145 through which the rectified carrier flows in opposition to the bias voltage. Thus, when the rectified carrier becomes strong enough to overcome the bias voltage on V111, V111 will draw plate current and produce a voltage drop across R146, thereby producing AVC voltage in proportion to the strength of the received signal. The bias on the grid of V111 is high enough to produce a delay in the generation of AVC voltage and thus allows the receiver to function at full sensitivity on weak signals. Resistor R144 and capacitor C205B form the time constant

in the AVC circuit. R171, C208, and R167 are used in a degenerative circuit to prevent the AVC amplifier tube from responding to low audio frequencies. AVC is turned off by opening the plate circuit of AVC amplifier tube V111. Tubes controlled by AVC bias include the r-f amplifier V101, the 500 kc i-f amplifier tubes, V107, V108 and V109.

4.2.12. AUDIO AMPLIFIER. - Two stages of audio amplification are employed in the 51J-3 receiver. The first stage utilizes the second triode section of V112 in a resistance-coupled amplifier arrangement. A type 6AQ5 miniature pentode power amplifier tube is used in the audio output stage. This stage has fixed bias obtained from the voltage drop produced across R166 in the center tap lead of the high voltage transformer secondary. The secondary of the audio output transformer has both 600-ohm and 4-ohm outputs. Both the outputs are terminated on the rear of the chassis at terminal strip E102. Plug-in connections to both outputs are also made on the front panel.

4.2.13. 50 OHM I-F OUTPUT. - One-half of dual triode V111 supplies 50-ohm, 500-kc i-f to coaxial connector J104 on the rear of the chassis. This section of V111 is used as a cathode follower. Excitation is obtained from the voltage drop across R178, which is connected in a series circuit across the secondary of i-f transformer T105.

4.2.14. 100 KC CALIBRATOR. - This calibrator is included with the receiver for use when extreme accuracy of calibration in the order of 200 cycles is desired. It is coupled to the grid of r-f amplifier tube V101, and is made operable when CALIBRATOR ON-OFF switch S111 is turned on. The calibrator utilizes a 6BA6 tube in a Pierce circuit, a low drift 100 kc crystal between the control grid and screen, and a 5-25 uuf capacitor C169 between grid and ground. The capacitor permits the making of small frequency corrections that set the calibrator to zero beat with a primary frequency standard. Variable capacitor C224 on the front panel provides for fine adjustment of frequencies.

4.2.15. POWER SUPPLY. - The receiver is equipped with a power transformer that is connected for a 115-volt source. However the transformer can be used on a 230 volt source by re-connecting the primary windings in series. The power supply is capable of producing 220 d-c volts at 125 ma. A two section choke input filter is used following a 5V4 high vacuum rectifier. The filter consists of a 3 henry input choke, a 5 henry output choke and two 35 mfd filter capacitors. B+ for the audio output is taken from the junction of the two chokes. The receiver's ON-OFF switch, and a 1.5 ampere, slow-blow fuse are located in the primary circuit of the power supply. 6.3 volts a-c are furnished for the tube filaments and dial lights from a winding on the power transformer.

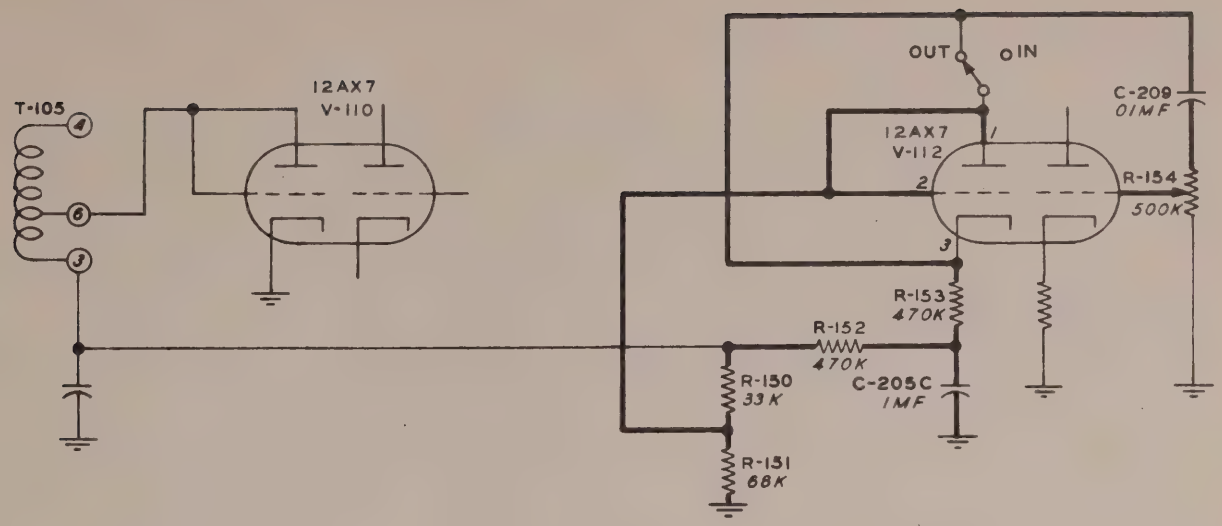



Figure 4-4. 51J-3 Noise Limiter Circuit

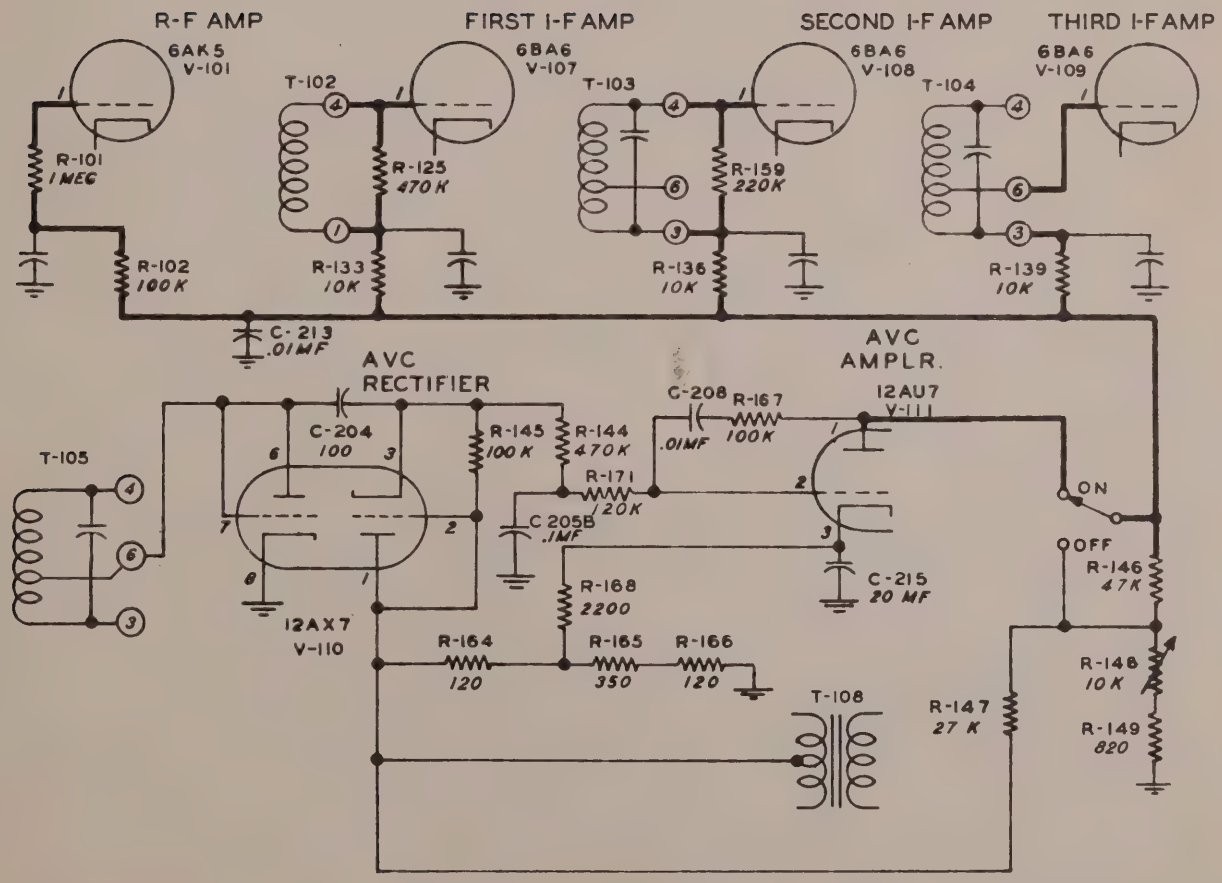



Figure 4-5. 51J-3 A.V.C. Circuit

# SECTION 5

# MAINTENANCE

## 5.1. INSPECTION.

5.1.1. GENERAL. - This radio equipment has been constructed of materials considered to be the best obtainable for the purpose, and has been carefully inspected and adjusted at the factory to reduce maintenance to a minimum. However, a certain amount of checking and servicing will be necessary to maintain efficient and dependable operation. The following section has been written to aid in checking the equipment.

5.1.2. ROUTINE INSPECTION. - Routine inspection schedules should be set up for periodic checks of this equipment. This inspection should include examination of the mechanical system for excessive wear or binding, and of the electrical system for electrical defects and deterioration of components.

If routine inspection of the equipment is carried out faithfully, the chances of improper operation of the equipment are greatly minimized. It is important, therefore, that this inspection be made as frequently as possible, and should be sufficiently thorough to include all major electrical circuits of the equipment as well as the mechanical portion.

5.1.3. CLEANING. - The worst enemies of uninterrupted service in equipment of this type are dirt and corrosion. Dirt reduces efficiency and causes undue wear of rotating parts, Corrosion most seriously affects contacts such as those on tap switches, tubes, relays and cables. Like salt laden air, dirt and moisture accelerate corrosion. The result may be equipment failure for no apparent reason.

Periodic dusting of accessible parts by means of a soft brush and a jet of dry, oil-free air removes foreign particles. Under certain conditions it is difficult or virtually impossible to prevent accumulation of moisture. Even so, frequent wiping of parts lessens danger of corrosion. If the atmosphere is corrosive, frequent inspection and wiping of parts is of especial importance.

5.1.4. VACUUM TUBES. - Check the emission characteristics of all tubes; then examine all tube prongs to make sure they are free from corrosion. Straighten bent pins with a tube pin straightener. See that all tubes are firmly seated in their proper sockets, and that a good electrical contact exists between tube prong and socket. Before discarding a tube, be sure that it is at fault and that the trouble is not due to a loose or broken connection within the equipment. Keep an extra set of tested tubes on hand at all times. If an equipment's faulty performance seems due to tube failure, check the tubes by replacing them with the extras. Inspection will usually locate

defective tubes that are overloading power circuits. Excessive heating or sputtering within a vacuum tube indicates a fault in the tube circuit.

5.1.5. TUBE REPLACEMENT PRECAUTIONS.

(a) Remove tubes by pulling them straight up.

(b) Before inserting a tube, make certain that the pins are straight and that it is of the correct type for the socket into which it is to be placed.

5.1.6. TUBE TABLE.

RECEIVER:

| Symbol | Type | Function |
|---|---|---|
| V101 | 6AK5 | RF amplifier |
| V102 | 6BE6 | First mixer |
| V103 | 6BE6 | Band 1 mixer |
| V104 | 6BA6 | Calibration oscillator |
| V105 | 6AK5 | Crystal h-f oscillator |
| V106 | 6BE6 | Second mixer |
| V107 | 6BA6 | First 500 kc i-f amplifier |
| V108 | 6BA6 | Second 500 kc i-f amplifier |
| V109 | 6BA6 | Third 500 kc i-f amplifier |
| V110 | 12AX7 | Detector and AVC rectifier |
| V111 | 12AU7 | AVC amplifier and i-f ouput cathode follower |
| V112 | 12AX7 | Noise limiter and first audio amplifier |
| V113 | 6AQ5 | Audio power amplifier |
| V114 | 6BA6 | Beat frequency oscillator |
| V115 | 5V4 | Power rectifier |
| V116 | 0A2 | Voltage regulator |
| V001 | 6BA6 | Variable frequency oscillator |
| V002 | 6BA6 | Oscillator isolation amplifier |

5.2. TROUBLE SHOOTING.

5.2.1. GENERAL. - Improper performance of radio equipment is usually due to tube failure. Refer to paragraph 5.1.4. In general, the type of trouble encountered in radio apparatus can be ascertained by means of various tests and measurements. Components in the associated circuit may then be checked and the cause of trouble located.

Useful resistance and voltage measurements will be found in table 5-1.

NOTE

NO ONE BUT AN AUTHORIZED AND COMPETENT SERVICE MAN EQUIPPED WITH PROPER TEST FACILITIES SHOULD BE PERMITTED TO SERVICE THIS EQUIPMENT.

5.2.2. FUSES. - This equipment contains fuses of the correct rating. Replace blown fuses only after carefully examining affected circuits to make certain that no permanent fault exists. Use only 1.5 ampere, slow-blow fuses.

5.3. ALIGNMENT.

5.3.1. GENERAL. - Should the receiver get out of alignment, return it to satisfactory performance by means of the following procedure.

5.3.2. EQUIPMENT AND TOOLS USED FOR ALIGNMENT.

(a) 500-kc to 30.5-mc signal generator.

(b) D-c vacuum tube voltmeter.

(c) Oscilloscope.

(d) Detuning network consisting of a .01 capacitor and 4700-ohm resistor in series with clip leads.

(e) Fiber or bakelite adjusting tool, 1/8-inch diameter with screwdriver type bit. (Supplied)

(f) Fiber or bakelite adjusting tool, 5/16-inch diameter with screwdriver type bit. (Supplied)

(g) Small screwdriver.

NOTE

IF A SIGNAL GENERATOR IS NOT AVAILABLE THE CALIBRATION OSCILLATOR MAY BE USED FOR ALIGNMENT. USE THE PROCEDURE OUTLINED BELOW BUT LEAVE THE CALIBRATION OSCILLATOR ON. TUNE RECEIVER TO EACH ALIGNMENT FREQUENCY BY TURNING THE KILOCYCLE KNOB UNTIL A PEAK READING IS OBTAINED ON THE INPUT METER, AND TUNE TRIMMERS AND CORES, USING INPUT METER TO INDICATE MAXIMUM READINGS.

5.3.3. CRYSTAL OSCILLATOR TRIMMER ADJUSTMENT.

(a) Adjust trimmer C167, marked XTAL on chassis, to provide an input capacitance of 32 mmf across the crystal holders. This value will occur at or near minimum capacitance setting. If this capacitor is badly

mistuned, the crystals will be off frequency and low in output.

(b) Connect a 470K-ohm resistor to pin 7 of tube V102. Connect VTVM between free end of 470K-ohm resistor and chassis. This resistor reduces the effect of the capacitance of the meter lead.

(c) In all of the following adjustment, peak the trimmers if the indicated voltage is not more than 2 volts. If it is more than 2 volts, detune trimmer toward minimum capacitance, until voltage reads 2. See figure 5-1.

(1) Repeat, tuning trimmer marked 30, with bandswitch on band 30.

(2) Repeat, tuning trimmer marked 28, with bandswitch on band 28.

(3) Repeat on even bands from 26 through 14, tuning correspondingly marked trimmers.

(4) Repeat with bandswitch on band 1. Adjust trimmer labeled B.C. that is nearer V105.

(d) Remove 470K-ohm resistor from V102. Connect the resistor to pin 1 of V103. Connect VTVM between free end of resistor and chassis.

(e) Place bandswitch on band 1. Tune for maximum indication on VTVM the trimmer marked B.C. that was not previously tuned.

5.3.4. 100 KC OSCILLATOR ALIGNMENT. - Calibrate the 100-kc crystal oscillator by means of the CAL trimmer, C169, using a secondary frequency standard. D-c grid voltage on V104 as measured with the d-c VTVM is a negative 15-30 volts minimum.

5.3.5. FIXED 500 KC I-F AMPLIFIER ALIGNMENT. - Connect signal generator between pin 7 of V106 and chassis. Connect one end of a clip lead to output of crystal oscillator at C173. Hold other end near grid of V106. Set signal generator to zero beat at 500 kc. Turn off 100-kc oscillator and remove clip lead. Connect detuning network consisting of an .01-mf capacitor in series with a 4700-ohm resistor from plate of V107 to chassis. Connect VTVM from diode load resistor R151 to chassis. Place S114 in "0" position.

(a) Tune secpndary of T103 by adjusting the bottom slug for maximum indication. Keep diode load voltage below 3 volts by adjusting signal generator output.

(b) Connect detuning network from terminal 4 of T103 to chassis. Tune top slug, or primary, for maximum indication.

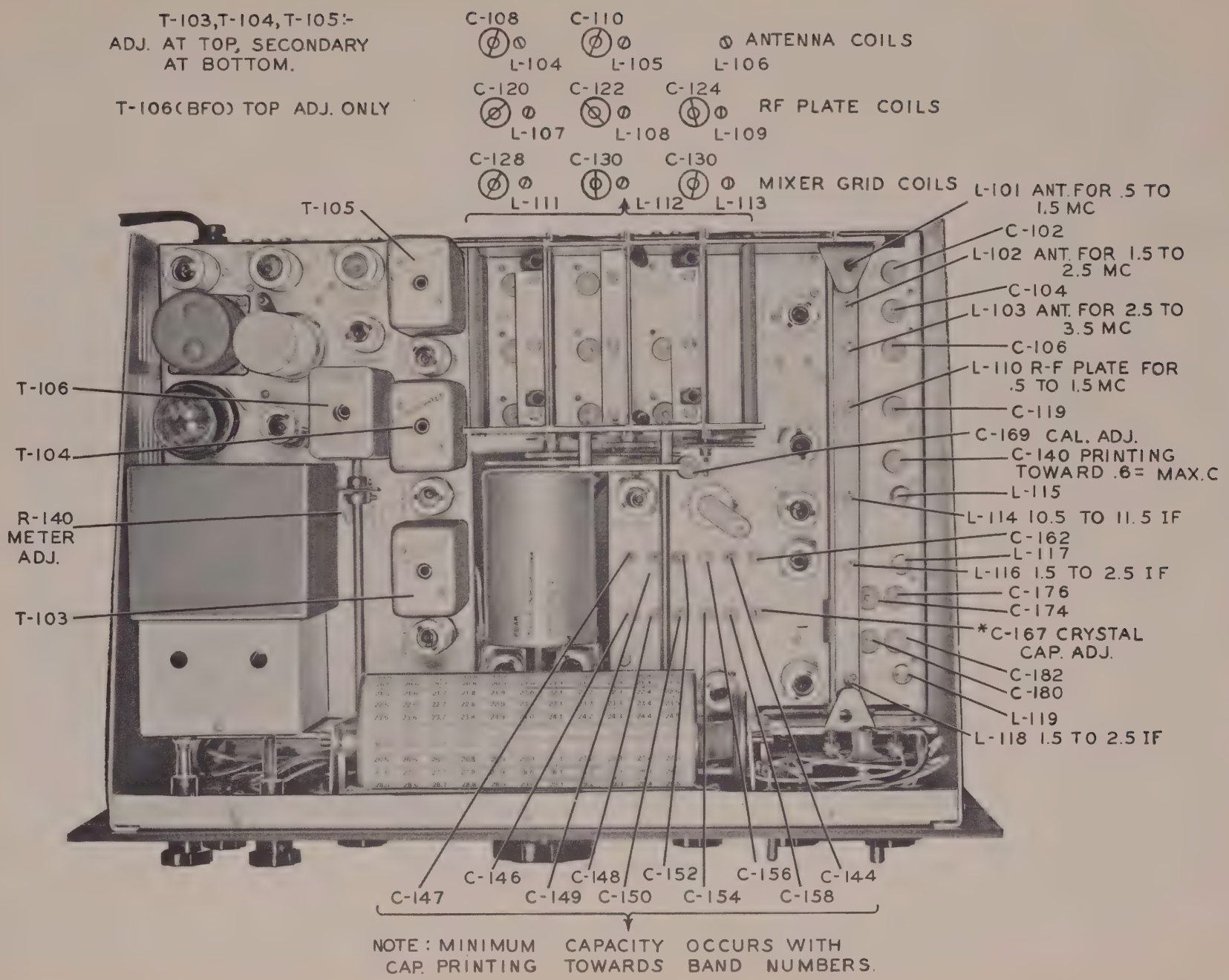



Figure 5-1. 51J-3 Alignment Adjustments

(c) Connect detuning network from plate of V108 to chassis. Tune secondary of T104 for maximum indication.

(d) Connect detuning network to terminal 4 to T104. Tune primary of T104 for maximum indication.

(e) Connect detuning network to plate of V109. Tune secondary of T105 for maximum indication.

(f) Connect detuning network to terminal 4 of T105. Tune primary of T105 for maximum indication.

(g) Tune T101 for maximum VTVM indication.

(h) If the BFO PITCH knob has never been removed from the shaft during the life of the receiver, align the BFO as follows. Turn BFO On. Set the line on the BFO PITCH knob at the fiducial mark on the panel. Adjust core in T106 to zero beat.

If the BFO PITCH knob has ever been removed from the shaft, align the BFO as follows. Turn BFO on. Adjust core in T106 to produce a beat note. Line up the knob with the panel mark and with the mid-range point of the BFO pitch capacitor by turning the knob to either the right or the left of the fiducial panel mark until pitch of beat note rises to a maximum. Leave knob exactly at point of maximum pitch. BFO PITCH capacitor plates are now either all in or all out. Loosen set screws in BFO PITCH knob. Rotate knob on shaft until knob mark is 90° from panel mark. Tighten set screws. Set knob mark at fiducial mark on panel. BFO PITCH capacitor is now at mid-range. Adjust core of T106 to zero beat. (A method of aligning the BFO without a signal generator is given in paragraph 5.3.6. below.)

(i) Align T102 as follows:

(1) Use an oscilloscope and a frequency-modulated signal generator having a sweep rate of four cycles per second, a frequency excursion of about 20 kc and a carrier frequency between 1.5 and 3.5 mc.

(2) Line up the crystal filter PHASING control knob with the panel mark and with the mid-range position of the phasing capacitor. To accomplish this, with the aid of a flashlight look into the right-hand hole in the top of the crystal filter cover in order to see the plates of the phasing capacitor. Turn the PHASING control until the rotor plates are straight down toward the bottom of the receiver, i.e., until the rotor plates completely engage the bottom set of stator plates. Loosen set screws in PHASING control knob. Set knob line 90° to the left of the panel mark. Tighten set screws. Turn knob to panel mark. Phasing capacitor is now at mid-range.

(3) Connect signal generator lead to pin 7 of V106. Connect oscilloscope lead to junction of R150 and R152. Turn on generator and oscilloscope and allow them to warm up.

(4) Turn SELECTIVITY switch to position 1. Turn AVC off, LIMITER off, BFO off, CALIBRATE off and AUDIO GAIN to position 0. Tune receiver to carrier frequency of signal generator.

(5) Turn RF GAIN to mid-range and synchronize scope. Two fairly symmetrical peaks should appear on the scope screen. If they do not, adjust receiver tuning, RF GAIN and oscilloscope controls until they do appear. Each of these peaks is essentially an i-f response curve.

(6) Rotation of the PHASING control to the left should cause a rejection notch to appear at one side of each peak. If this notch does not appear, set the PHASING control about one-eighth turn to the left of center and adjust the core in top of T102(accessible through the right-hand hole in the crystal filter cover) until it does appear and is well-defined on the scope screen. Adjust until no evidence of a damped oscillation remains.

(7) Turn PHASING control about one-eighth turn to the right of center. The rejection notch should appear at the other side of each peak, and, without further adjustment, should be well-defined and without evidence of a damped oscillation. If this is not the case, adjust T102 core slightly.

(8) Repeat steps (4) and (5) until the notch obtained in one of the steps looks symmetrical with respect to the notch obtained in the other step and gives no evidence of a damped oscillation.

5.3.6. ALTERNATE BFO ALIGNMENT METHOD. - The following paragraphs describe how to align the BFO when a signal generator is not availabe. For the standard alignment procedure, which requires a signal generator, refer to paragraph 5.3.5. above for the set-up, and to 5.3.5.(h) for the procedure.

(a) Disconnect antenna from terminal at rear of chassis. Turn 100-kc crystal oscillator on and BFO on.

(b) Tune receiver to a 100-kc check point on bands 2 or 3. For example, tune receiver to 2.0 mc.

(c) Line up the knob with the panel mark and with the mid-range point of the BFO PITCH capacitor as follows: If the BFO PITCH knob has never been removed from the shaft during the life of the receiver, turn the knob until the knob mark lines up with the panel mark on the receiver. If the BFO PITCH knob has ever been removed from the shaft, adjust the core in T106 to produce a beat note. Turn BFO PITCH knob either to the right or to the left of the panel mark until the beat note's pitch rises to a maximum. Leave knob exactly at point of maximum pitch. BFO PITCH capacitor plates are now either all in or all out. Loosen set screws in BFO PITCH knob. Rotate knob on shaft

until knob mark is 90° from panel mark. Tighten set screws. Turn knob to mark on panel. BFO PITCH is now at mid-range.

(d) Tune receiver at least 10 kc off of any 0.1 megacycle point on bands 2 or 3 and turn up AUDIO GAIN until a constant pitch beat note is audible. If the constant pitch beat note is not audible, adjust tuning core in top of T106 until it is. Make certain that this is the correct note by turning the KILOCYCLE dial ±10 kc and noting whether the pitch of the beat note remains constant. This constant pitch beat note, which occurs only on bands 2 and 3, is produced by a small amount of fifth harmonic from the 100-kc oscillator that leaks into the i-f strip through the second mixer stage and beats with the signal from the BFO. Because of the superior strength of the calibration beat note in the vicinity of a 100-kc check point, this constant pitch beat note is most audible about half-way between check points.

(e) Adjust tuning core of T106 for zero beat. The BFO frequency is now 500 kc when the BFO PITCH knob is set at the fiducial mark on the panel.

5.3.7. 500 KC I-F PERFORMANCE MEASUREMENTS.

(a) Sensitivity. - The input to V106 at 500 kc should be within 25 to 40 uv for 4 volts at the diode load.

(b) Selectivity.

(1) Adjust the output level of the signal generator for 4 volts at the diode load. This voltage and the output level of the signal generator are the reference voltages.

(2) Increase the output level of the signal generator 6 db (twice the voltage). Determine the bandwidth by noting how far on either side of resonance the signal from the generator must be detuned in order to lower the diode voltage to 4 volts.

(3) Repeat step 2 for 60 db increase (1000 times the voltage) in signal input level.

(4) The overall selectivity specifications are:

a. Minimum selectivity

| | | |
|---|---|---|
| 6 db | 5.5 kc min. | 6.5 kc max. |
| 60 db | 17.0 kc min. | 20.0 kc max. |

b. Maximum selectivity (crystal filter in)

| | | |
|---|---|---|
| 6 db | 0.2 kc min. | 0.3 kc max. |
| 60 db | 0.2 kc min. | 12.0 kc max. |

## 5.3.8. ALIGNMENT OF DIALS WITH VFO

(a) MEGACYCLE DIAL POINTER. - It is very unlikely that the pointer on the MEGACYCLE dial will become inaccurate through normal use of the receiver. However, if the dial pointer has accidently been slipped with respect to the cord, reset it as follows: Take off escutcheon plate; then rotate KILOCYCLE knob counterclockwise until it hits the mechanical stop. Then rotate it a fraction of a turn clockwise until the zero-zero mark lines up with the fiducial. From this point rotate KILOCYCLE knob exactly five turns clockwise. Grasp the dial cord and slide the MEGACYCLE pointer along it to the center frequency of the band. For example, if the receiver is set at band 2, set pointer exactly at 2.0 mc. Replace escutcheon plate.

(b) KILOCYCLE DIAL. - If the KILOCYCLE dial reading is incorrect first determine the magnitude and direction of the errors then correct them according to the procedures outlined below. To determine the nature of the errors, set the receiver on band 2 with the BAND CHANGE knob. Set KILOCYCLE fiducial line to center mark on escutcheon opening by turning ZERO ADJ knob. Set BFO exactly at 500 kc as in paragraph 5.3.6. Turn on the 100 kc oscillator with CALIBRATE switch. Turn KILOCYCLE knob to zero beat. Note the magnitude and direction of error in the KILOCYCLE dial reading. Tune receiver to 2.5 mc. With BFO still set at exactly 500 kc, turn KILOCYCLE knob to zero beat. Again, note magnitude and direction of error in KILOCYCLE dial reading.

(1) If the KILOCYCLE dial reading is incorrect by less than 3 kc in the same direction by the same amount at both ends of the MEGACYCLE dial, correct as follows:

a. Be sure BFO is set at 500 kc as in paragraph 5.3.6.

b. Tune the receiver to zero beat at the 100 kc check point nearest the dial setting at which maximum accuracy is desired. For example, if maximum accuracy is desired at 1.83 mc, tune to zero beat at 1.8 mc by turning the KILOCYCLE knob.

c. Set KILOCYCLE fiducial line to zero-zero on the KILOCYCLE dial by turning the ZERO ADJ knob.

(2) If the KILOCYCLE dial reading is incorrect by more than 3 kc in the same direction by the same amount at both ends of the MEGACYCLE dial, correct as follows:

a. Be sure BFO is set at 500 kc as in paragraph 5.3.6.

b. Tune to zero beat at 1.5 mc.

c. Set KILOCYCLE fiducial line to center index mark on escutcheon opening by turning ZERO ADJ knob.

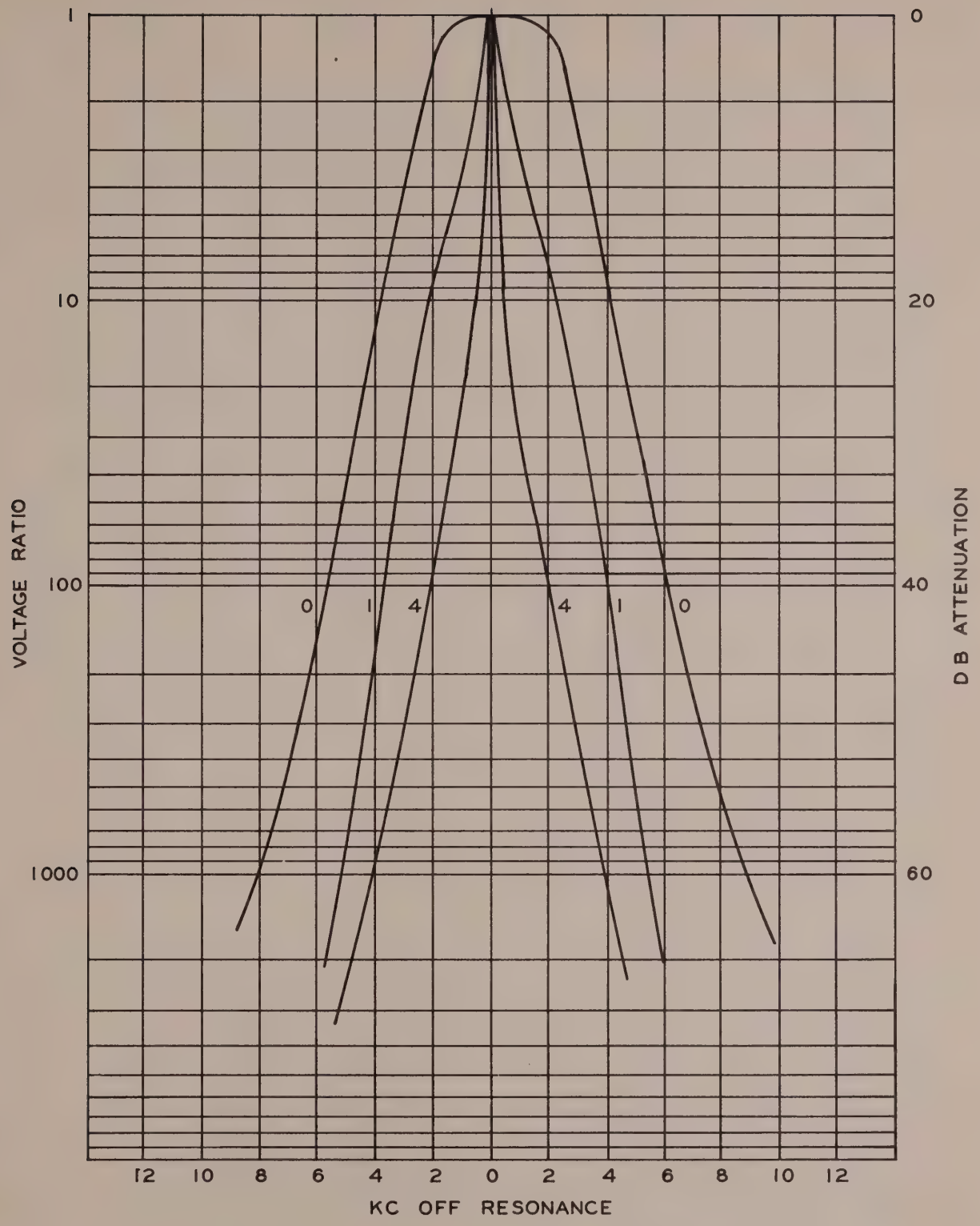



Figure 5-2. 51J-3 Selectivity Curves

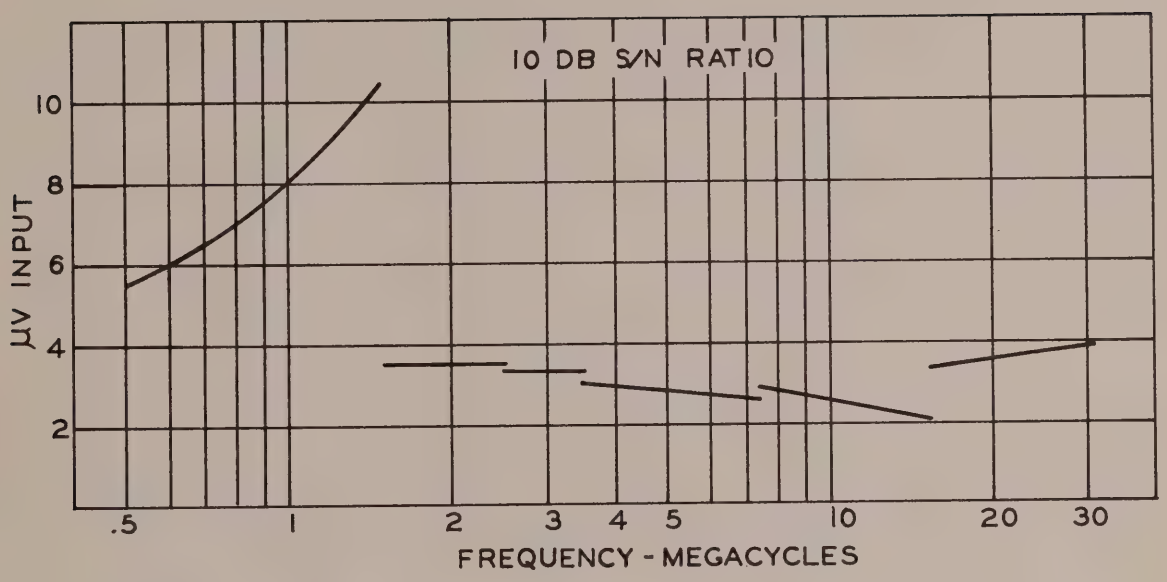



Figure 5-3. 51J-3 Sensitivity Curve

d. Loosen set screws in the circular KILOCYCLE dial and set to zero-zero. Tighten set screws.

(3) If the two errors in the KILOCYCLE dial reading are either opposite in direction or different in size, it indicates that the VFO end points have drifted. Correct as follows:

a. Be sure BFO is set at 500 kc as in paragraph 5.3.6. Tune receiver to zero beat at 1.5 mc on band 2.

b. If the zero-zero mark on the KILOCYCLE dial lies within the lines on the escutcheon opening, set KILOCYCLE fiducial line to zero-zero on the KILOCYCLE dial by turning the ZERO ADJ knob.

c. If the zero-zero mark lies outside the lines on the escutcheon opening, loosen set screws in the KILOCYCLE dial. Set fiducial to the center line in the escutcheon opening. Rotate KILOCYCLE dial until zero-zero mark lines up with the fiducial. Tighten set screws.

d. Rotate KILOCYCLE knob approximately ten turns to zero beat. This procedure tunes the receiver to 2.5 mc.

e. Now note the error in the KILOCYCLE dial reading.

f. If this error is less than ±3 kc, set the fiducial to 2.5 mc by turning the ZERO ADJ knob. This procedure sets the point of maximum accuracy at 2.5 mc. If maximum accuracy is desired at some other check point in the band, tune the receiver to zero beat at the desired check point. Then adjust fiducial to zero-zero on the KILOCYCLE dial.

g. If this error is more than ±3 kc, refer to paragraph 5.3.15. for instructions.

(c) Check the VFO frequency against a known source to determine whether the VFO shaft has been displaced a full turn, and thereby has shifted the VFO frequency exactly 100 kc. Using a signal generator having an accuracy of ±1% or ±20 kc or another 51J-3 receiver known to be properly aligned, check as follows.

(1) Set BFO exactly at 500 kc as in paragraph 5.3.6. Turn 100-kc oscillator OFF.

(2) If the signal generator is used, connect its output to pin 7 of V106 with a clip lead. Set generator at 2.0 mc. Tune receiver to zero beat at 2.0 mc. If the VFO shaft is displaced a full turn, zero beat will occur within 20 kc of 1.9 mc or 2.1 mc instead of 2.0 mc.

(3) If an accurately aligned 51J-3, hereafter called the test receiver, is used, couple the antenna jack of the test receiver to the

output of the VFO that is being checked. Set BFO of test receiver at 500 kc.. Turn on 100-kc oscillator in test receiver. Tune the receiver containing the VFO being checked to 2.0 mc. Tune the test receiver to zero beat at 2.5 mc. If the shaft of the VFO being checked is displaced a full turn, zero beat will occur at 2.4 mc or 2.6 mc instead of 2.5 mc.

(4) If steps (2) or (3) reveal that the VFO shaft is displaced a full turn, correct as follows.

a. Connect a clip lead from pin 7 of V106 to the 100-kc oscillator output at C173. Turn on 100-kc oscillator. With BFO set at 500 kc as in paragraph 5.3.6., tune receiver to zero beat at 2.5 mc. Loosen set screws in VFO coupler.

b. If zero beat occurred at 2.1 mc instead of at 2.0 mc in step (2), or at 2.4 mc instead of at 2.5 mc in step (3), the VFO frequency is 100 kc less than it should be. Correct by turning VFO shaft one full turn counterclockwise to zero beat.

c. If zero beat occurred at 1.9 mc in step (2) or at 2.6 mc in step (3) the VFO frequency is 100 kc more than it should be. Correct by turning VFO shaft one full turn clockwise to zero beat.

d. Tighten set screws in VFO shaft coupler.

5.3.9. VARIABLE I-F ALIGNMENT.

(a) Connect signal generator in series with a 47 ohm resistor and a 100 uuf capacitor to the ANTENNA terminal. Connect VTVM between diode load resistor R151 and chassis. Switch receiver to band 2. Set dial to read 1.6 mc. Set ANT TRIM to mid-range.

(b) Turn BFO on and set signal generator to zero beat at 1.6 mc. Turn BFO off. Adjust output of signal generator to give some value of diode load voltage below 5 volts. Tune slugs marked 1.6 (in L116, L118 and L102) for a maximum indication while adjusting the signal generator to keep diode load voltage below 5 volts.

(c) Set dial to read 2.4 mc. Set generator to zero beat at 2.4 mc with BFO. Turn BFO off. Tune adjustments marked 2.4 (trimmer capacitors C174, C180, and C104) for a maximum indication, keeping diode load voltage below 5 volts.

(d) Repeat tuning procedures at 1.6 and 2.4 mc until no further increase in output can be obtained.

NOTE

IN THE FOLLOWING RF ALIGNMENT PROCEDURES KEEP DIODE LOAD VOLTAGE BELOW 5 VOLTS AS IN PARAGRAPH 5.3.9.(b) ABOVE.

5.3.10. RF ALIGNMENT BAND 3.

(a) Connect the signal generator and VTVM as in step 5.3.9.(a). Set bandswitch to band 3.

(b) Set dial to read 2.6 mc. Set signal generator to zero beat at 2.6 mc with BFO. Turn BFO off. Adjust tuning cores marked 2.6 (in L117, L119 and L103) for a maximum indication.

(c) Set dial to read 3.4 mc. Set signal generator to zero beat at 3.4 mc with BFO. Turn BFO off. Adjust trimmer capacitors marked 3.4 (C176, C182 and C106) for a maximum indication.

(d) Repeat tuning procedures at 2.6 and 3.4 mc until no further increase in output can be obtained.

5.3.11. RF ALIGNMENT BANDS 4-7.

(a) Connect signal generator and VTVM as in step 5.3.9.(a). Set bandswitch to band 4.

(b) Set dial to read 4.0 mc. Set signal generator to zero beat at 4.0 mc with BFO. Turn BFO off. Adjust tuning cores marked 4.0 (in L104, L107 and L111) for maximum indication.

(c) Set bandswitch to band 7. Set dial to read 7.0 mc. Set signal generator to zero beat at 7.0 mc with BFO. Turn BFO off. Tune trimmer capacitors marked 7.0 (C108, C120 and C128) for maximum indication.

(d) Repeat tuning procedures at 4.0 mc and 7.0 mc until no further increase in output can be obtained.

5.3.12. RF ALIGNMENT BANDS 8-15.

(a) Connect signal generator and VTVM as in step 5.3.9.(a).

(b) Set bandswitch to band 8. Set dial to 8.0 mc. Set signal generator to zero beat with BFO at 8.0 mc. Turn BFO off. Tune trimmer capacitors marked 8 (C110, C122 and C130) for maximum indication.

(c) Set bandswitch to band 15. Set dial to read 15.0 mc. Set signal generator to zero beat with BFO at 15.0 mc. Turn BFO off. Tune trimmer capacitors marked 15 (C110, C122 and C130) for maximum indication.

(d) Repeat tuning procedures at 8.0 mc and 15.0 mc until no further increase in output can be obtained.

5.3.13. RF ALIGNMENT BANDS 16-30.

(a) Connect signal generator and VTVM as in step 5.3.9.(a).

(b) Set bandswitch to band 16. Set dial to 16.0 mc. Set signal generator to zero beat with BFO at 16.0 mc. Turn BFO off. Adjust tuning cores marked 16 (in L106, L109 and L113) for a maximum indication.

(c) Set bandswitch to band 30. Set dial to 30.0 mc. Set signal generator to zero beat with BFO at 30.0 mc. Turn BFO off. Adjust trimmer capacitors C124, C132 and ANT TRIM for a maximum indication.

(d) Repeat tuning procedures at 16.0 and 30.0 mc until no further increase in output can be obtained.

5.3.14. RF ALIGNMENT BAND 1.

(a) Connect signal generator and VTVM as in step 5.3.9.(a).

(b) Set bandswitch to band 1. Set dial to 0.6 mc. Set generator to zero beat with BFO at 0.6 mc. Turn BFO off. Adjust core in L114 so that it is in approximately the same position in the inductor as the cores in L116 and L118. Adjust cores marked 0.6 (in L101 and L110) for a maximum indication. Adjust trimmer capacitor marked 0.6 (C140) for a maximum indication.

NOTE

TWO PEAKS MAY BE FOUND WHEN TUNING C140. USE THE PEAK THAT REQUIRES THE HIGHER VALUE OF CAPACITANCE. Refer to C140 in figure 5-1.

(c) Set dial to 1.4 mc. Set signal generator to zero beat with BFO at 1.4 mc. Turn BFO off. Tune trimmers marked 1.4 (C102 and C119) for a maximum indication. Adjust core marked 1.4 (in L115) for a maximum indication.

(d) Repeat tuning procedures at 0.6 and 1.4 mc until no further increase in output can be obtained.

5.3.15. VFO ALIGNMENT.

(a) GENERAL. - During manufacture of the VFO the frequency-determining elements are hermetically sealed within the outer cylindrical cover while they are being held at a high temperature. This drives out practically all moisture and creates a partial vacuum within the sealed compartment. Because of the method of fabrication and the efficiency of design, it is quite unlikely that the VFO will become misaligned through normal use or

treatment. However, if it does become sufficiently misaligned, as indicated by the procedure outlined in paragraph 5.3.8.(b)(3), it must be returned to the factory for permanent alignment. Because alignment procedure involves breaking of the hermetic seal by removal of a small plug, the future stability of the VFO will be seriously impaired if conditions under which it was manufactured are not duplicated during alignment. Therefore, it is possible to align the VFO only temporarily without sending it back to the factory. If the VFO is to be sent back to the factory refer to paragraph 5.4. for instructions on removal. This temporary alignment can be performed by a qualified and properly equipped service technician, but should be attempted only in case of emergency. All components not contained within the sealed cover can be maintained in the field.

WARNING

DO NOT, UNDER ANY CIRCUMSTANCES, ATTEMPT TO REMOVE THE OUTER CYLINDRICAL COVER. THIS NOT ONLY BREAKS THE HERMETIC SEAL BUT EXPOSES THE FREQUENCY CORRECTOR MECHANISM AND THE CAREFULLY COMPENSATED FREQUENCY-DETERMINING ELEMENTS.

(b) PROCEDURE.

(1) Before aligning the VFO be sure that the BFO is set at 500 kc as in paragraph 5.3.6., that the 500-kc i-f channel is aligned and that the 100-kc oscillator is turned off.

(2) Use a signal generator having an output of 1.5 mc with better than ±25 kc accuracy.

(3) Loosen set screws in the flexible VFO coupler, and slide the coupler hubs apart. Remove the receiver's front panel and the VFO mounting screws. Pull out the VFO and carefully allow it to hang on the connecting wires. Mount a small circular dial on the VFO shaft. This dial must have a linear scale from 0 to 100 completely around its periphery. Affix a small wire for use as a pointer on one of the VFO mounting screws. One division of the dial will equal one kilocycle.

(4) Turn the receiver ON and short the antenna terminal to chassis. Because none of the receiver's variable tuned circuits are used in this procedure, leave the receiver dials at whatever frequency they happen to be on when the receiver is turned on.

(5) Couple the 1.5 mc output from the signal generator to pin 1 of V106.

(6) Find the low frequency endpoint (2.0 mc) of the VFO by turning the VFO shaft clockwise to the last zero beat obtainable in that direction.

CAUTION

DO NOT FORCE THE VFO SHAFT BY ATTEMPTING TO TURN IT FURTHER WHEN IT REACHES THE STOP AT EITHER END OF THE RANGE.

(7) The VFO setting is now within 20 kc of 2.0 mc and must be adjusted more accurately as follows. Uncouple signal generator from pin 1 of V106. Connect a clip lead from the 100 kc oscillator at C173 to pin 1 of V106. Turn 100-kc oscillator on. Carefully rotate VFO shaft to the nearest zero beat. VFO setting is now exactly 2.0 mc. Place VFO dial pointer at zero, being careful to retain the zero beat setting.

(8) Rotate the VFO shaft exactly 10 turns in a counterclockwise direction, counting exact turns with the VFO shaft dial. Find zero beat by turning the VFO shaft a few divisions toward either side of the 10-turn mark.

(9) If zero beat occurs on either side of the 10-turn mark, note the magnitude and direction of the error by counting divisions between zero and the pointer. Multiply this number of error divisions by 1.5.

(10) If zero beat occurs at less than 10 turns, rotate the VFO shaft counterclockwise by the number of divisions arrived at in step (9) (1.5 times the error divisions).

(11) If zero beat occurs at more than 10 turns, rotate the VFO shaft clockwise by the number of divisions arrived at in step (9) (1.5 times the error divisions).

(12) Remove the hex plug from the front of the oscillator. Using the outer part of the special VFO adjustment tool illustrated in figure 5-7, loosen the lock nut that is visible when the hex plug is removed. Insert the screwdriver portion of the VFO tool into the outer portion. Adjust the trimmer screw by turning the screwdriver until zero beat is again reached. Tighten lock nut, being careful to retain zero beat.

(13) The high and low end (2.0 and 3.0 mc) zero beat positions should now be exactly ten turns apart. If this is not the case, repeat the above procedure until they are. It will be necessary to zero the dial pointer at the initial zero beat position each time this procedure is repeated. Be sure to tighten the lock nut after making each trimmer adjustment. Be careful not to lose the endpoints by counting incorrectly or forgetting the count. If they are lost turn off the 100-kc oscillator and start the procedure over at step (5).

(14) After separating the 2.0 and 3.0 mc endpoints of the VFO by exactly 10 turns, replace the hex plug, put the VFO in the receiver and replace the front panel. Align the receiver dials with the VFO according to the procedure outlined in paragraph 5.3.8.(b)(2). It is not necessary to readjust the r-f and i-f amplifiers for small changes in the VFO adjustment.

(c) EXAMPLES. - The following examples illustrate the procedure outlined in paragraph (b).

NOTE

DO NOT ATTEMPT TO FOLLOW THESE EXAMPLES AS INSTRUCTIONS. THEY ARE INCLUDED FOR ILLUSTRATIVE PURPOSES ONLY.

(1) Zero the pointer at the low frequency endpoint (2.0 mc) of the VFO. Read zero on the shaft dial. Rotate shaft exactly 10 turns counterclockwise. Again read zero on the dial. A beat note is audible at this setting. Find zero beat by turning VFO shaft by 4 divisions clockwise. This indicates that the endpoints are 4 divisions less than 10 turns apart. Multiply the 4 error divisions by 1.5 to arrive at 6. Rotate VFO shaft counterclockwise by 6 divisions since zero beat occurs at less than 10 turns. Turn trimmer screw to zero beat. Rotate VFO shaft exactly 10 turns clockwise to check whether the endpoints are now exactly 10 turns apart. If they are not, repeat procedure in paragraph (b) until they are.

(2) Zero the pointer at the low frequency endpoint (2.0 mc) of the VFO. Read zero on the shaft dial. Rotate shaft exactly 10 turns counterclockwise. Again read zero on the dial. A beat note is audible at this setting. Find zero beat by turning VFO shaft by 5 divisions counterclockwise. This indicates that the endpoints are 5 divisions more than 10 turns apart. Multiply the 5 error divisions by 1.5 to arrive at 7.5. Rotate VFO shaft clockwise by 7.5 divisions since zero beat occurs at more than 10 turns. Turn trimmer screw to zero beat. Rotate VFO shaft exactly 10 turns clockwise to check whether the endpoints are now exactly 10 turns apart. If they are not, repeat procedure in paragraph (b) until they are.

5.3.16. ADJUSTMENT OF L-124. - Reach L-124 from the bottom of the chassis. Adjust as follows.

(a) Turn BFO ON and tune in the spurious signal at 1250 kc.

(b) Adjust L-124 for greatest attenuation of the spurious signal.

5.4. COMPLETE VFO REMOVAL. - If the VFO has to be completely removed from the receiver for servicing, proceed as follows.

(a) Remove the front panel and allow it to swing forward on the wires. (See paragraph 5.6.2. for detailed instructions on removing the front panel.)

(b) Loosen set screws in the flexible coupler. Pull the coupler apart and remove the center disc.

(c) Mark the VFO connecting wires so that they may be reconnected correctly. Unsolder the wires.

(d) Remove the three screws that hold the VFO to the chassis.

(e) Slide the VFO back and tip the rear downward.

(f) Pull the VFO from the receiver.

5.5. DIAL BULB REPLACEMENT. - The lights for the slide rule dial are mounted in sockets which are clipped to the metal structure above the dial. To replace light bulbs slide the clips off the metal structure and pull out the sockets. Press down on the bulb slightly and turn it a fraction of a turn counterclockwise. When replacing the sockets, press the wires up into the channel. To remove the KILOCYCLE dial light, reach under the drum of the MEGACYCLE dial and grasp the frame of the dial light socket; then pull it back far enough to replace the bulb.

5.6. DIAL AND BAND CHANGE GEAR MAINTENANCE.

5.6.1. GENERAL. - The replacing and synchronizing of gears in the dial and band change mechanism of this receiver can be a difficult job. It is recommended that the unit be sent to the factory for servicing should any major repairs be required.

WARNING

IF DISASSEMBLY OF THE GEAR UNIT IS CONTEMPLATED, INSTRUCTIONS IN PARAGRAPHS 5.6.2. and 5.6.3. MUST BE FOLLOWED CLOSELY OR IT WILL BE IMPOSSIBLE TO SYNCHRONIZE THE GEARS UPON REASSEMBLY.

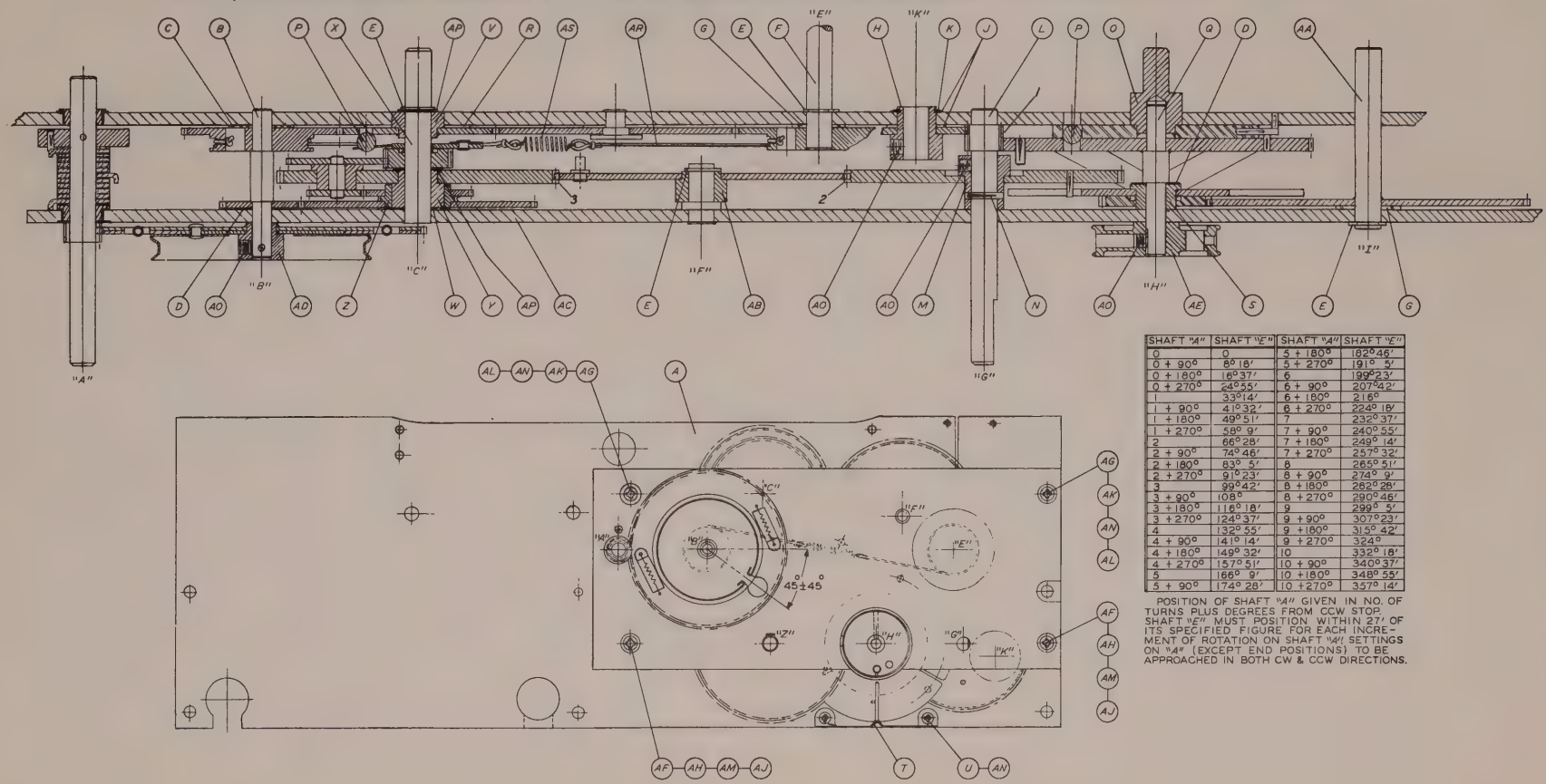
5.6.2. DISASSEMBLY OF GEAR BOX.

(a) If the gear box is to be returned to the factory for servicing, proceed as follows.

(1) Set the receiver on its back. Remove the following knobs: SELECTIVITY, PHASING, BFO PITCH, BAND CHANGE, KILOCYCLE tuning, and ANT TRIM. Remove the collar, tension washer and flat washer from the KILOCYCLE shaft. Remove the screws that fasten the front panel to the chassis. Lift the panel off and carefully allow it to hang to one side on the cable wires.

| ITEM NO. | QUANTITY | PART NO. | PART NAME |
|---|---|---|---|
| A | 1 | 504 3142 003 | BACK GEAR PANEL ASSY |
| B | 1 | 504 3111 002 | REV. GEARS & SHAFT ASSY |
| C | 1 | 504 2973 001 | WASHER |
| D | 2 | 500 2112 002 | WASHER |
| E | 4 | 340 0025 00 | RETAINING RING |
| F | 1 | 504 3014 001 | I.F. DRIVER GEAR & SHAFT ASSY |
| G | 2 | 500 1081 003 | WASHER |
| H | 1 | 504 3004 001 | GEAR ASSY-SWITCH, I.F. |
| J | 2 | 500 1109 003 | WASHER |
| K | 1 | 340 0013 00 | RETAINING RING |
| L | 1 | 504 2956 001 | MC. KNOB SHAFT |
| M | 1 | 504 3013 001 | KNOB GEAR & HUB ASSY |
| N | 1 | 311 1122 30 | GROOVE PIN |
| O | 1 | 504 3006 001 | SHAFT ASSY-BAND SWITCH |
| P | 2 | 309 5200 00 | BALL-3/16 DIA. |
| Q | 1 | 504 3012 001 | SHAFT ASSY-GENEVA WHEEL |
| R | 1 | 504 2972 001 | THRUST BEARING |
| S | 1 | 504 3015 001 | HUB ASSY-GENEVA WHEEL |
| T | 1 | 504 2932 001 | CENTERING SPRING |
| U | 2 | 343 0165 00 | 6-32 X 1/8 PBH SCREW |
| V | 1 | 504 3018 001 | HUB ASSY-DETENT GEAR |
| W | 1 | 504 2974 001 | WASHER |
| X | 1 | 504 3025 001 | DETENT SPRING ASSY |
| Y | 1 | 504 3020 001 | CENTER PLANET-GEAR & HUB ASSY |
| Z | 1 | 504 3016 001 | HUB ASSY-FLOATING |
| AA | 1 | 504 3005 001 | SHAFT & GEAR ASSY |
| AB | 1 | 504 3009 001 | STOP IDLER GEAR HUB ASSY |
| AC | 1 | 504 3141 003 | FRONT GEAR PANEL ASSY |
| AD | 1 | 504 3024 001 | POINTER PULLEY ASSY |
| AE | 1 | 504 2954 001 | PULLEY-DRUM |
| AF | 2 | 504 2960 001 | STANDOFF-LOWER |
| AG | 2 | 504 2991 001 | STANDOFF-UPPER |
| AH | 4 | 343 0186 00 | 8-32 X 5/16 SCREW |
| AJ | 4 | 310 6380 00 | WASHER #8 FLAT |
| AK | 4 | 343 0167 00 | 6-32 X 1/4 SCREW |
| AL | 4 | 310 6360 00 | WASHER #6 FLAT |
| AM | 4 | 373 0003 00 | WASHER #8 SHAKE |
| AN | 6 | 373 0001 00 | WASHER #6 SHAKE |
| AO | 6 | 328 0002 00 | 6-40 X 1/8 SET SCREW |
| AP | 4 | 500 1112 003 | WASHER |
| AR | 1 | 432 1009 00 | LOADING CORD FT. |
| AS | 1 | 502 1158 002 | SPRING |

NOTE:
CROSS-SECTIONAL DETAIL AT LEFT IS NOT A TRUE LAYOUT.
SHAFTS ARE LOCATED TO SHOW GEAR MESH.
FOR TRUE LOCATION OF SHAFTS, GEARS AND PINS, REFER TO FRONT VIEW OF ASSEMBLY BELOW.




| SHAFT "4" | SHAFT "E" | SHAFT "4" | SHAFT "E" |
|---|---|---|---|
| 0 | 0 | 5 + 180° | 182° 46' |
| 0 + 90° | 8° 18' | 5 + 270° | 191° 5' |
| 0 + 180° | 16° 37' | 6 | 199° 23' |
| 0 + 270° | 24° 55' | 6 + 90° | 207° 42' |
| 1 | 33° 14' | 6 + 180° | 216° |
| 1 + 90° | 41° 32' | 6 + 270° | 224° 18' |
| 1 + 180° | 49° 51' | 7 | 232° 37' |
| 1 + 270° | 58° 9' | 7 + 90° | 240° 55' |
| 2 | 66° 28' | 7 + 180° | 249° 14' |
| 2 + 90° | 74° 46' | 7 + 270° | 257° 32' |
| 2 + 180° | 83° 5' | 8 | 265° 51' |
| 2 + 270° | 91° 23' | 8 + 90° | 274° 9' |
| 3 | 99° 42' | 8 + 180° | 282° 28' |
| 3 + 90° | 108° | 8 + 270° | 290° 46' |
| 3 + 180° | 116° 18' | 9 | 299° 5' |
| 3 + 270° | 124° 37' | 9 + 90° | 307° 23' |
| 4 | 132° 55' | 9 + 180° | 315° 42' |
| 4 + 90° | 141° 14' | 9 + 270° | 324° |
| 4 + 180° | 149° 32' | 10 | 332° 18' |
| 4 + 270° | 157° 51' | 10 + 90° | 340° 37' |
| 5 | 166° 9' | 10 + 180° | 348° 55' |
| 5 + 90° | 174° 28' | 10 + 270° | 357° 14' |

POSITION OF SHAFT "4" GIVEN IN NO. OF TURNS PLUS DEGREES FROM CCW STOP. SHAFT "E" MUST POSITION WITHIN 27' OF ITS SPECIFIED FIGURE FOR EACH INCREMENT OF ROTATION ON SHAFT "4". SETTINGS ON "4" (EXCEPT END POSITIONS) TO BE APPROACHED IN BOTH CW & CCW DIRECTIONS.

Figure 5-4. 51J-3 Dial and Bandswitch Gear Box

(2) Remove the right-hand end bracket from the chassis.

(3) Loosen set screws in the following couplers: VFO, r-f slug rack and i-f slug rack shafts, all accessible from the top of the receiver, and two band change shafts, accessible from the bottom.

(4) Remove the VFO mounting screws and the gear box mounting screws. Lift the gear box from the receiver.

(b) If repairs are to be made in the field, the gear box may either be removed from the receiver or left in, depending on the extent of repairs. If the box is to be removed, turn the MEGACYCLE knob to its clockwise stop and the KILOCYCLE knob to its counterclockwise stop, and follow the instructions in paragraph 5.6.2.(a); then proceed according to the following steps. If the box is to be left in the receiver, perform steps (1) and (2) under paragraph 5.6.2.(a); then proceed according to the following steps. Refer to figures 4-2 and 5-4 for location of gears and shafts.

(1) Turn shaft G (BAND CHANGE) clockwise to the stop below band 1. Turn shaft A counterclockwise to the stop.

(2) Scribe a mark across the 85-tooth spider gear that carries the planetary gears, and across the 90-tooth stop-pin gear, using the top of the front gear panel as a guide.

(3) Scribe a radial mark, precisely under the Geneva wheel detent, on the 144-tooth gear that has two stop pins attached.

(4) Using the circumference of the Geneva wheel as a guide, scribe a mark on the 85-tooth gear that drives the Geneva wheel.

(5) Scribe a mark through the edge of the small dial cord pulley and the front gear panel.

(6) Remove pin from hub of large dial cord pulley.

(7) Remove large dial cord pulley and gear.

(8) Remove small dial cord pulley.

(9) Remove retaining ring from shaft I (shown as shaft Z in the front view of gear plate in figure 5-4).

(10) Using a pair of right angle TRUARC pliers or two bent (right angle) scribes, remove retaining ring from shaft F.

(11) Measure and record the length of loading spring using a pair of dividers.

(12) Remove four mounting screws from front gear panel.

(13) Remove front gear panel, being very careful not to let shafts ride up with plate. While removing this panel, do not allow gears to unmesh or rotate.

(14) Keep shim washers with respective gears or shafts.

(15) Before moving or disengaging any gears other than the 90-tooth gear on shaft F, scribe a line through detent spring, 48-tooth detent gear, and rear gear panel, and another line through the 52-tooth gear on shaft E and rear gear panel.

(16) Mark all gears being removed in such a manner that they may be identified later for reassembly.

(17) If the overtravel coupler is removed, note that the disc and gear are detented. Do not lose detent ball.

(18) Make all necessary repairs. If any parts that have been scribed are to be replaced, be sure to scribe the new parts in exactly the same manner before placing them in the equipment. If the loading cord is to be replaced, form a small loop at one end of each of the two pieces to provide anchors for the spring. Push free ends of the cords through the proper pulley-holes. Knot the free ends after allowing for five inch lengths of cord between the loops and knots. Coat the knots with Duco cement.

5.6.3. REASSEMBLY OF GEAR BOX. - The following procedure assumes that all gears have been removed, that all repairs have been made, and that the gear and shaft assemblies have been reassembled after repairs were made.

(a) Use AN-G-25 grease on all bearing surfaces during assembly.

(b) If the 74-tooth idler gear whose shaft is riveted to the rear gear panel was removed, replace it first.

(c) Replace 48-tooth gear and shaft K assembly and shim washers, item J. Replace retaining ring.

(d) Replace 52-tooth gear and shaft E assembly and washer, item G. Line up scribe marks on gear and rear panel. Replace retaining ring.

(e) Replace 48-tooth detent gear, shaft C, detent, and 16-tooth gear assembly. Line up marks on rear panel, 48-tooth gear, and detent spring.

(f) Replace 85-tooth spider gear, 45-tooth, and 25-tooth planetary gear assembly, and shim washer, item AP, on shaft C. Do not move other gears already lined up with the scribe marks.

(g) Replace 48-tooth gear, shaft B, 24-tooth gear assembly, and washers, items C and D as follows:

Wind the loading cord about 1-1/2 turns clockwise on the pulley that is attached to the 52-tooth gear on shaft E. Do not move gears while doing this. Hook spring onto both halves of the loading cord. Insert shaft B into hole on rear plate, but do not yet engage the 48-tooth gear with the detent gear. While holding the 52-tooth gear and shaft E assembly, and the detent gear at their respective scribe marks, rotate shaft B counter-clockwise until loading spring stretches to the length measured before disassembly. Engage 48-tooth gear with detent gear while maintaining tension on the loading spring.

(h) Replace the 72-tooth gear and 50-tooth sun gear assembly and shim washer, item W, while holding 85-tooth spider gear so that the scribe mark on it is horizontal (parallel with the top and bottom edges of the gear panels). Keep all other gears set at the scribe marks.

(i) Reassemble overtravel disc with the 144-tooth overtravel gear. Detent the two together with detent ball. Use AN-G-25 grease to hold ball in place.

(j) Replace overtravel assembly, lining up mark on overtravel gear with notch on Geneva detent spring.

(k) Replace 85-tooth gear, shaft G, and 16-tooth gear assembly, lining up arcuate scribe mark with circumference of overtravel gear. (This mark will later line up with the Geneva wheel, but at present it is concentric with the overtravel gear. Make sure that alignment desribed in step (h) is maintained.

(l) Replace Geneva wheel and 33-tooth gear assembly and shim washer, item D. Be sure Geneva drive pin is engaged with slot in the Geneva wheel while the Geneva wheel detent is engaged, and that the arcuate scribe mark on the 85-tooth drive gear lines up with the circumference of the Geneva wheel.

(m) Replace 90-tooth gear and shaft I assembly, and washer, item G. Position is not critical.

(n) Lay the 90-tooth stop-pin gear in position with the scribe mark horizontal across the top, and collinear with scribe mark on the 85-tooth spider gear (parallel to the top and bottom enges of the gear panels).

(o) Replace front gear panel as follows: While sliding the panel into position, slide the 90-tooth stop-pin gear on its shaft which is attached to the front panel, being careful to keep scribe mark lined up with the mark on the 85-tooth spider gear. Also keep arcuate mark on the 85-tooth

Geneva drive gear lined up with the circumference of the Geneva wheel. Further, keep the mark on the 144-tooth overtravel coupler gear lined up with notch in the Geneva wheel detent. Replace screws in front gear panel.

(p) Check operation of the BAND CHANGE gear. If the gear box has been removed from the receiver, make the check while holding the gear box in a horizontal plane with the front gear panel facing down, so that the 90-tooth stop-pin gear will not fall off during the check. If the gear box has not been removed from the receiver, replace the retaining ring on the 90-tooth stop-pin gear shaft before making the check. Then, in either case, proceed as follows:

(1) Shaft G should now be against the clockwise stop, and should detent when turned counterclockwise approximately 45°. The ball on shaft C will now detent shaft G every 180°.

(2) When shaft G is turned counterclockwise 7-1/2 revolutions, or 15 detent positions from the first detent position, the pin in the 144-tooth gear on shaft H (figure 5-4), and the radial pin on the overtravel disc rotate clockwise until the radial pin just touches or is about to touch the pin in the rear gear panel. Further rotation of shaft G causes the pin in the gear to leave the radial pin that was stopped by the pin in the rear gear panel. Thus the overtravel coupler output shaft, which drives r-f switches S101 through S107 (figure 4-2), rotates 300° for the first 16 detent positions of shaft G and remains at that setting for further counterclockwise rotation of shaft G.

(3) Shaft G should rotate 14 more detent positions or 7 revolutions from the sixteenth detent position, and should hit the counter-clockwise stop approximately 45° past the thirtieth detent position. If the stop pins intersect before this, adjust them by changing phase relations of the gears at points 1, 2, and 3, shown in figure 5-4. Before deciding to change the relative positions of these gears, double check the conditions in steps (1), (2) and (3). If instructions in paragraphs 5.6.2. and 5.6.3. were followed precisely, operation of the BAND CHANGE gear train should meet the conditions set forth in these steps.

(4) The Geneva wheel should turn one notch when shaft G turns counterclockwise from an even-numbered to an odd-numbered detent position. (Count the first detent position from the clockwise stop as number 1.) Thus shaft I should rotate through 14 positions, or 280°, for 30 detent positions, or 14-1/2 turns, of shaft G. The initial position of shaft I should correspond to detent positions 1 and 2 of shaft G, the second shaft I position should correspond to detent positions 3 and 4 of shaft G, and so on through to the thirtieth detent position of shaft G.

(q) After accomplishing proper operation of the BAND CHANGE gear train, replace the retaining ring on the 90-tooth stop-pin gear shaft.

(r) Replace large dial cord pulley and gear assembly as follows: Turn shaft A to counterclockwise stop. Make sure that the 52-tooth gear on shaft E and the 48-tooth detent gear on shaft C are still set at their respective scribe marks. Place pulley and gear assembly far enough on shaft.B to engage the rear section of the split gear with the 15-tooth gear on shaft A. Be sure that groove-pin holes on shaft and hub are lined up and that the pulley slot is within 45° of the position shown in figure 5-4. Rotate front section of split gear so that springs stretch to 3/4 inches. Engage front section with 15-tooth gear on shaft A. Replace groove pin and tighten set screw.

(s) Check operation of loading cord by turning shaft A clockwise. Be sure that the loading spring travels from the drum on shaft E to the same relative position at the drum on shaft B when shaft A hits the clockwise stop. The loading spring should not touch either drum at either end of its travel.

(t) Replace small dial cord pulley. Line up with scribe mark and tighten set screw.

(u) Rotate shaft A to its counterclockwise stop, and shaft G to its clockwise stop; then replace the gear box in the receiver. Reconnect couplers; then replace dial cords, front panel and right-hand end bracket. Replace flat washer, tension washer and collar on KILOCYCLE shaft. Push collar against tension washer until tension washer is almost flat; then tighten collar set screws. Replace knobs.

## 5.7. RF TUNER ASSEMBLY MAINTENANCE.

5.7.1. GENERAL. - The r-f tuner assembly will require very little maintenance. However, should it be taken apart for any reason, the following information will indicate the correct positions of the cams.

5.7.2. POSITIONS OF CAMS. - The front plate of the slug rack assembly contains three alignment holes as indicated in figure 5-5. If the cams are correctly synchronized, the tips of the front cams will be directly opposite these holes. Use a dental mirror to accurately inspect the position of the cam tips in relation to the alignment holes. If a dental mirror is not available, check positions and operation of the cams in the following manner.

(a) Turn BAND CHANGE knob to band 30. Turn KILOCYCLE knob clockwise to stop.

(b) Viewing the right-hand slug-moving cam from the front, the slug table cam rider should be approximately 1/16 inches to the right of the cam tip. The cam rider should descend this same right-hand edge when step (c) is performed.

(c) Turn BAND CHANGE knob to band 16. Turn KILOCYCLE knob counterclockwise to stop. The cam rider should still be on the same side of the cam as in step (b), and not bottomed in the low spot of the cam.

(d) Turn BAND CHANGE knob to band 15. Turn KILOCYCLE knob clockwise to stop.

(e) Viewing the center cam from the front, the cam rider should be approximately 1/32 inches to the left of the cam tip. The cam rider should descend this same left-hand edge when step (f) is performed.

(f) Turn BAND CHANGE knob to band 8. Turn KILOCYCLE knob counterclockwise to stop. The cam rider should still be on the same side of the cam as in step (e) and not bottomed in the low spot of the cam.

(g) Turn BAND CHANGE knob to band 7. Turn KILOCYCLE knob clockwise to stop.

(h) Viewing the left-hand cam from the front, the cam rider should be approximately 1/32 inches to the right of the cam tip. The cam rider should descend this same right-hand edge when step (i) is performed.

(i) Turn BAND CHANGE knob to band 4. Turn KILOCYCLE knob counterclockwise to stop. The cam rider should still be on the same side of the cam as in step (h) and not bottomed in the low spot of the cam.

(j) Before putting the receiver into operation again, investigate the electrical alignment of the stages affected by any repair operations, and check the synchronization of the slug rack with the BAND CHANGE mechanism.

## 5.8. DIAL CORDS.

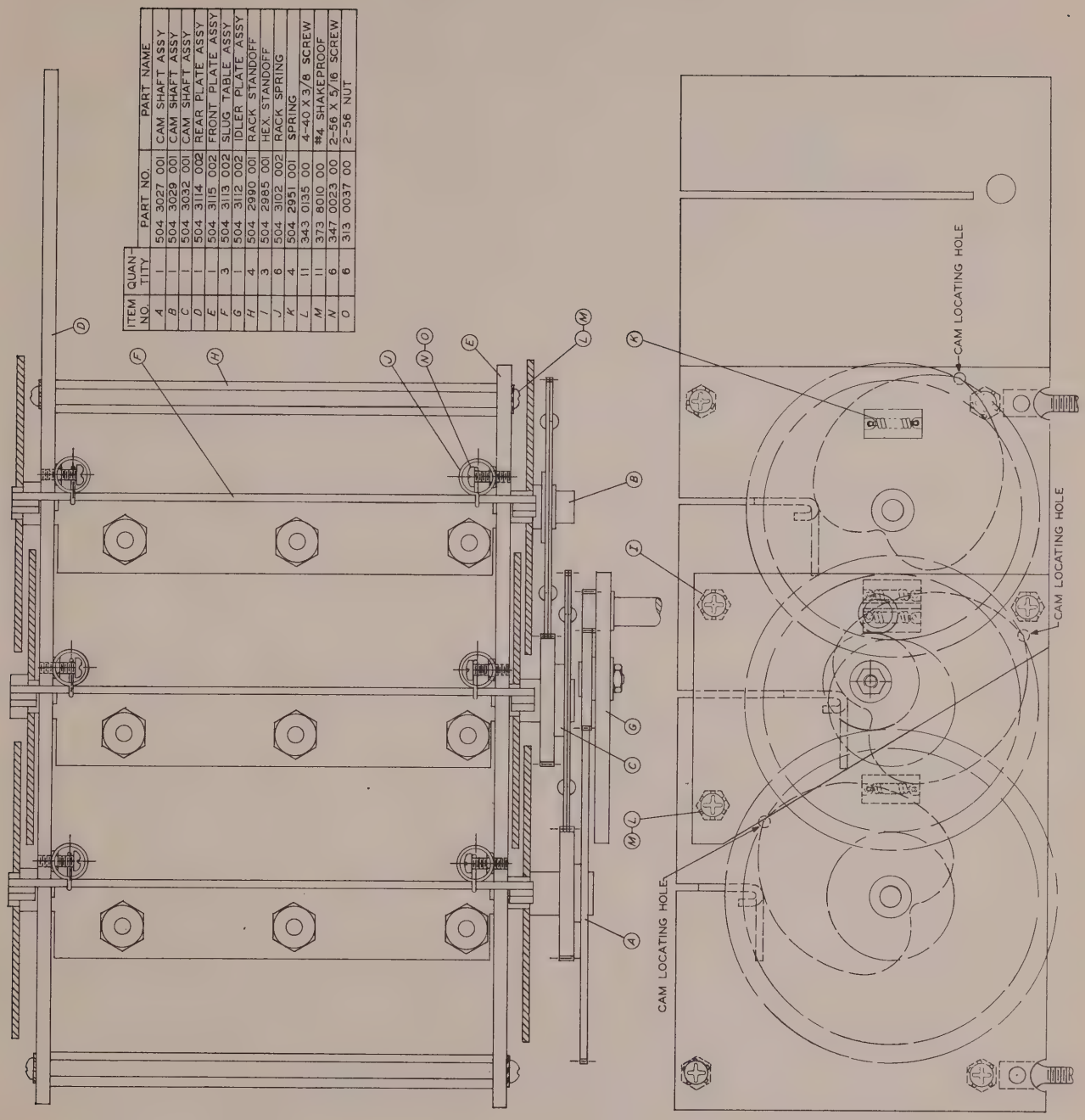
5.8.1. MEGACYCLE POINTER CORD. - Refer to figure 5-6. Remove the front panel according to directions in paragraph 5.6.2.(a). If the cord is to be replaced, use 36-5/8 inches of Collins number 432 1009 00 nylon-covered cord.

(a) Turn KILOCYCLE shaft counterclockwise to stop.

(b) Tie a loop in the cord. Loop the cord over the tab at point X in figure 5-6.

(c) Wind cord about one-half turn clockwise on pulley A, continue to pulley B, pointer, pulley C, and back to pulley A.

(d) Wind cord about 1-1/2 turns clockwise around pulley A. Fasten cord to the spring on pulley A with spring at full tension.




| ITEM NO. | QUANTITY | PART NO. | PART NAME |
|---|---|---|---|
| A | 1 | 504 3027 001 | CAM SHAFT ASS'Y |
| B | 1 | 504 3029 001 | CAM SHAFT ASSY |
| C | 1 | 504 3032 001 | CAM SHAFT ASSY |
| D | 1 | 504 3114 002 | REAR PLATE ASSY |
| E | 1 | 504 3115 002 | FRONT PLATE ASSY |
| F | 3 | 504 3113 002 | SLUG TABLE ASSY |
| G | 1 | 504 3112 002 | IDLER PLATE ASSY |
| H | 4 | 504 2990 001 | RACK STANDOFF |
| I | 3 | 504 2985 001 | HEX STANDOFF |
| J | 6 | 504 3102 002 | RACK SPRING |
| K | 4 | 504 2951 001 | SPRING |
| L | 11 | 343 0135 00 | 4-40 X 3/8 SCREW |
| M | 11 | 373 8010 00 | #4 SHAKEPROOF |
| N | 6 | 347 0023 00 | 2-56 X 5/16 SCREW |
| O | 6 | 313 0037 00 | 2-56 NUT |

Figure 5-5. 51J-3 R. F. Slug Rack

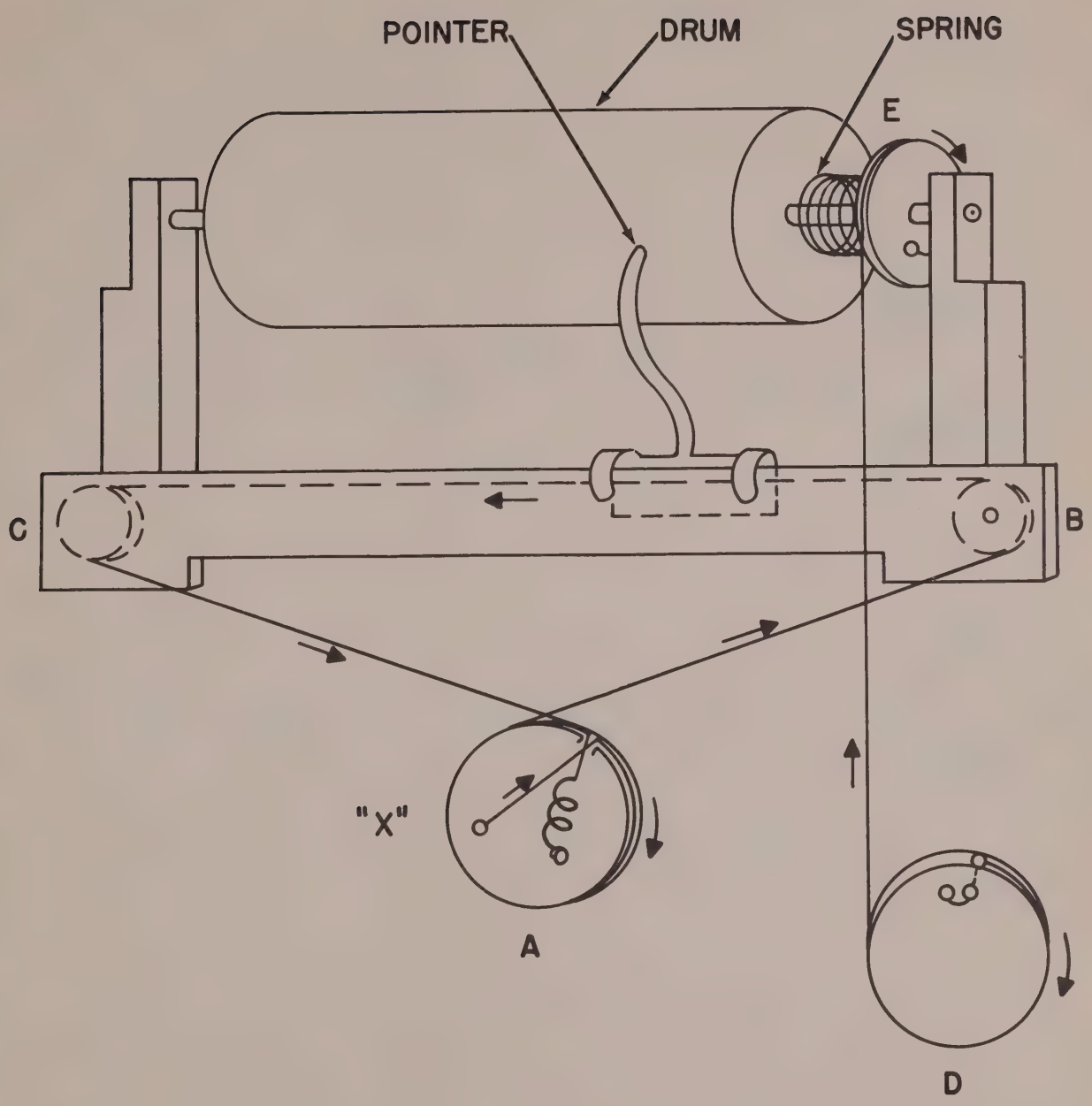



Figure 5-6. 51J-3 Dial Cord Arrangement

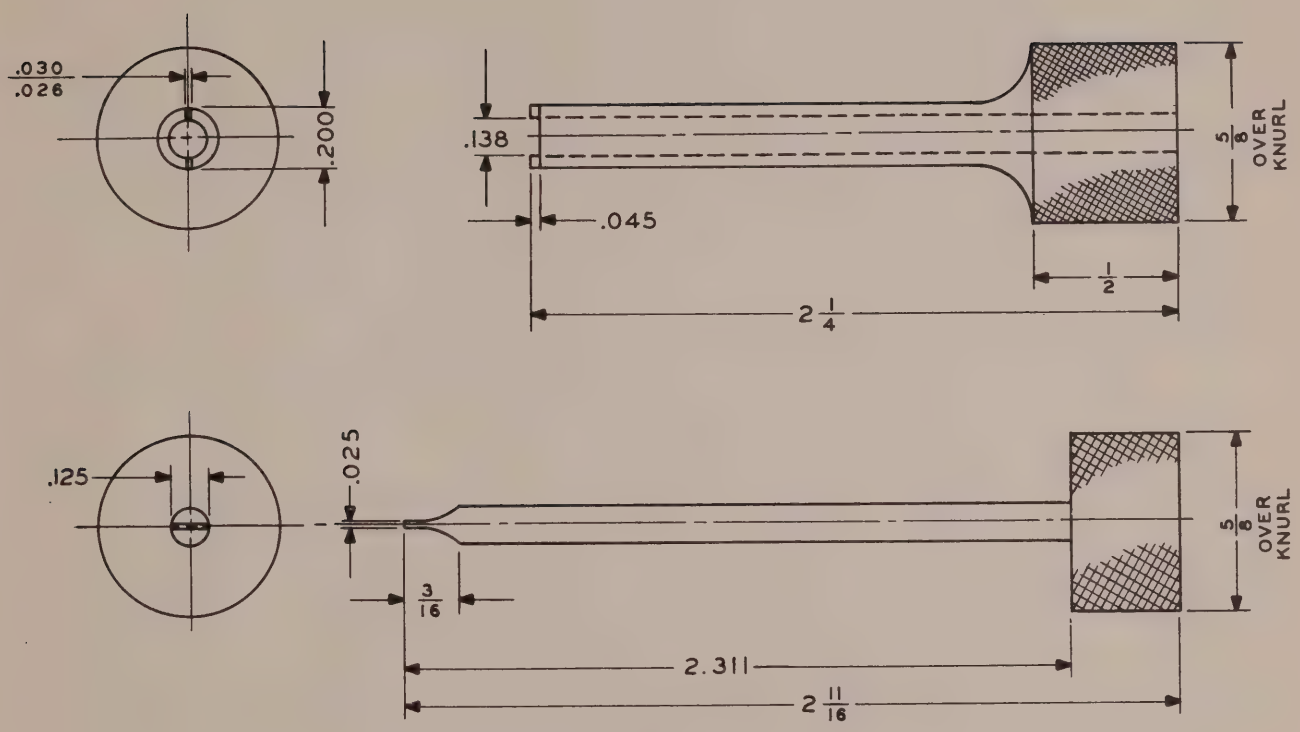



Figure 5-7. 51J-3 V. F. O. Adjustment Tool

(e) Replace front panel, KILOCYCLE shaft flat washer, tension washer and collar, and knobs.

5.8.2. DRUM CORD. - If the drum cord has jumped the pulleys, restring it without removing the front panel. If the cord is broken, remove the front panel as in paragraph 5.6.2. Use 27 inches of Collins 432 1009 00 nylon-covered cord for replacement.

(a) Turn BAND CHANGE knob to band 30.

(b) Turn pulley E, figure 5-6, about one-half turn and hold tension of spring.

(c) Insert cord in pulley D and knot it. Wind cord about three-fourths of a turn on pulley D; extend to pulley E, and wind it 1-1/2 turns or more around pulley E as needed. Insert cord in hole and knot it.

(d) Replace panel and knobs.

(e) Loosen set screw in drum hub and turn drum until 30-mc band is centered in the escutcheon opening; then tighten set screw.

TABLE 5-1

51J-3 TUBE SOCKET RESISTANCE AND VOLTAGE MEASUREMENTS

All measurements taken from socket pins to ground, resistance measurements taken with no a-c input, power on, gain controls on full, AVC on, all other switches off unless otherwise noted.

Voltage measurements taken with 115 volt a-c input, power on, no input signal, r-f gain full on, audio gain off, AVC on, all other switches off unless otherwise noted. Voltages measured with vacuum tube voltmeter, 11 megohms input resistance.

| TUBE | PIN | RESISTANCE | VOLTAGE | |
|---|---|---|---|---|
| V101 | 1 | 1.1 Meg | -1.2 | |
| 6AK5 | 2 | Gnd | Gnd | |
| | 3 | Gnd | Gnd | |
| | 4 | Fil | AC 6.3 | |
| | 5 | 58K | +58 | Band 1 |
| | | | +190 | Bands 2 - 3 |
| | | | +125 | Bands 4 - 30 |
| | 6 | 74K | +100 | |
| | 7 | Gnd | Gnd | |

| TUBE | PIN | RESISTANCE | VOLTAGE |
|---|---|---|---|
| V102<br>6BE6 | 1 | 22 | 0 Small indication on Bands 2 & 3 |
| | 2 | 4470 | +1.4 |
| | 3 | Gnd | Gnd |
| | 4 | Fil | AC 6.3 |
| | 5 | 43K | +180 Band 1<br>Small indication Bands 2 - 3<br>+210 Bands 4 - 30 |
| | 6 | 88K | +47 |
| | 7 | 330K | -1.3 to -4.5 |
| V103 | 1 | 100K | -1.3 Band 1<br>-2. Band 2<br>-0 Band 3 - 30 |
| | 2 | 470 | +1.8 |
| | 3 | Gnd | Gnd |
| | 4 | Fil | AC 6.3 |
| | 5 | 42K | +210 Band 1<br>0 Bands 2 - 30 |
| | 6 | 74K | +85 Band 1<br>+70 Bands 2 -30 |
| | 7 | .1 | 0 |
| V104<br>6BA6 | 1 | 680K | 0 Calibrate Off<br>-24 Calibrate On |
| | 2 | Inf Calibrate Off<br>4700 Calibrate On | +60 Calibrate Off<br>+7.2 Calibrate On |
| | 3 | Fil | AC 6.3 |
| | 4 | Gnd | Gnd |
| | 5 | 270K | +170 Calibrate Off<br>+80 Calibrate On |
| | 6 | 150K | +175 Calibrate Off<br>+64 Calibrate On |
| | 7 | Inf Calibrate Off<br>4700 Calibrate On | +60 Calibrate Off<br>+7.2 Calibrate On |
| V105<br>6AK5 | 1 | 100K | -10 to -30 |
| | 2 | 8 | +.1 |
| | 3 | Gnd | Gnd |
| | 4 | Fil | AC 6.3 |
| | 5 | 90K | +39 Bands 1 - 2 |

| TUBE | PIN | RESISTANCE | VOLTAGE |
|---|---|---|---|
| | | | +165 Bands 3 - 12 |
| | | | +39 Bands 13 - 0 |
| | 6 | 76K | +105 Bands 1 - 2 |
| | | | +115 Bands 3 - 12 |
| | | | +105 Bands 13 - 30 |
| | 7 | 8 | +.1 |
| V106 | 1 | 100K | -.2 |
| 6BE6 | 2 | 470 | +2.6 |
| | 3 | Gnd | Gnd |
| | 4 | Fil | AC 6.3 |
| | 5 | 42K | +205 |
| | 6 | 73K | +82 |
| | 7 | .4 | 0 |
| V107 | 1 | 58K | -1.4 |
| 6BA6 | 2 | Gnd | Gnd |
| | 3 | Gnd | Gnd |
| | 4 | Fil | AC 6.3 |
| | 5 | 40K | +155 |
| | 6 | 26K | +47 |
| | 7 | Gnd | Gnd |
| V108 | 1 | 58K | -1.4 |
| 6BA6 | 2 | Gnd | Gnd |
| | 3 | Gnd | Gnd |
| | 4 | Fil | AC 6.3 |
| | 5 | 38K | +160 |
| | 6 | 26K | +50 |
| | 7 | Gnd | Gnd |
| V109 | 1 | 58K | -1.4 |
| 6BA6 | 2 | 30 | +.03 |
| | 3 | Gnd | Gnd |
| | 4 | Fil | AC 6.3 |
| | 5 | 38K | +175 |
| | 6 | 85K | +90 |
| | 7 | 30 | +.03 |

| TUBE | PIN | RESISTANCE | VOLTAGE |
|---|---|---|---|
| V110<br>12AX7 | 1<br>2<br>3<br>4<br>5<br>6<br>7<br>8<br>9 | 550<br>550<br>100K<br>Fil<br>Fil<br>100K<br>100K<br>Gnd<br>Gnd | -56<br>-56<br>-53<br>AC 6.3<br>AC 6.3<br>-2.4<br>-2.4<br>Gnd<br>Gnd |
| V111<br>12AU7 | 1<br>2<br>3<br>4<br>5<br>6<br>7<br>8<br>9 | 48K<br>700K<br>2600<br>Fil<br>Fil<br>42K<br>100K<br>1000<br>Gnd | -1.4<br>-52<br>-44<br>AC 6.3<br>AC 6.3<br>+195<br>0<br>+6<br>Gnd |
| V112<br>12AX7 | 1<br>2<br>3<br><br>4<br>5<br>6<br>7<br>8<br>9 | 33K<br>33K<br>33K Limiter Off<br>1 Meg Limiter On<br>Fil<br>Fil<br>260K<br>500K<br>3300<br>Gnd | -.8<br>-.8<br>-.8 Limiter Off<br>-.3 Limiter On<br>AC 3.4<br>AC 6.3<br>+135<br>0<br>+1.2<br>0 |
| V113<br>6AQ5 | 1<br>2<br>3<br>4<br>5<br>6<br>7 | NC<br>Gnd<br>Gnd<br>Fil<br>40K<br>40K<br>100K | NC<br>Gnd<br>Gnd<br>AC 6.3<br>+220<br>+210<br>-12.5 |

| TUBE | PIN | RESISTANCE | VOLTAGE |
|---|---|---|---|
| V114<br>6BA6 | 1 | 100K | -.5 BFO Off<br>-10 BFO On |
| | 2 | Gnd | Gnd |
| | 3 | Gnd | Gnd |
| | 4 | Fil | AC 6.3 |
| | 5 | 75K<br>75K | 200 BFO Off<br>140 BFO On |
| | 6 | 0 BFO Off<br>142K BFO On | 0 BFO Off<br>69 BFO On |
| | 7 | .6 | 0 |
| V115<br>5V4G | 1 | NC | NC |
| | 2 | 40K | +240 |
| | 3 | NC | NC |
| | 4 | 620 | AC 300 |
| | 5 | NC | NC |
| | 6 | 620 | AC 300 |
| | 7 | NC | NC |
| | 8 | 40K | +240 |
| V116<br>0A2 | 1 | 44K | +150 |
| | 2 | NC | NC |
| | 3 | NC | NC |
| | 4 | Gnd | Gnd |
| | 5 | NC | NC |
| | 6 | NC | NC |
| | 7 | 44K | +150 |

51J-3 Receiver

| ITEM | CIRCUIT FUNCTION | DESCRIPTION | COLLINS PART NUMBER |
|---|---|---|---|
| C-101 | L-101 padding | CAPACITOR: mica, 820 mmf ±2%, 300 WV | 935 5014 00 |
| C-102 | L-101 trimming | CAPACITOR: variable ceramic, 8-50 mmf, 350 WV | 917 1038 00 |
| C-103 | L-102 padding | CAPACITOR: mica, 430 mmf ±2%, 300 WV | 912 0538 00 |
| C-104 | L-102 trimming | CAPACITOR: variable ceramic, 8-50 mmf, 350 WV | 917 1038 00 |
| C-105 | L-103 padding | CAPACITOR: mica, 220 mmf ±2%, 500 WV | 912 0517 00 |
| C-106 | L-103 trimming | CAPACITOR: variable ceramic, 8-50 mmf, 350 WV | 917 1038 00 |
| C-107 | L-104 padding | CAPACITOR: mica, 130 mmf ±5%, 500 WV | 912 0503 00 |
| C-108 | L-104 trimming | CAPACITOR: variable ceramic, 8-50 mmf, 350 WV | 917 1038 00 |
| C-109 | L-105 padding | CAPACITOR: mica, 20 mmf ±5%, 500 WV | 912 0443 00 |
| C-110 | L-105 trimming | CAPACITOR: variable ceramic, 5-25 mmf, 350 WV | 917 1036 00 |
| C-111 | V-101 grid coupling | CAPACITOR: ceramic, 2.0 mmf ±1/4 mmf, 500 WV | 916 4373 00 |
| C-112 | | CAPACITOR: Not used | |
| C-113 | V-101 grid coupling | CAPACITOR: mica, 100 mmf ±5%, 500 WV | 912 0494 00 |
| C-114 | V-101 grid decoupling | CAPACITOR: ceramic, 10,000 mmf, 350 WV | 913 0566 00 |
| C-115 | V-101 screen bypass | CAPACITOR: ceramic, 10,000 mmf, 350 WV | 913 0566 00 |
| C-116 | V-102 grid coupling | CAPACITOR: ceramic, 1.0 mmf ± 1/4 mmf, 500 WV | 916 4368 00 |
| C-117 | V-101 plate coupling, | CAPACITOR: ceramic, 2.0 mmf ± 1/4 mmf, 500 WV | 916 4373 00 |
| C-118 | L-110 padding | CAPACITOR: mica, 910 mmf ±1%, 500 WV | 935 5015 00 |
| C-119 | L-110 trimming | CAPACITOR: variable ceramic, 8-50 mmf, 350 WV | 917 1038 00 |

| ITEM | CIRCUIT FUNCTION | DESCRIPTION | COLLINS PART NUMBER |
|---|---|---|---|
| C-120 | L-107 trimming | CAPACITOR: variable ceramic, 8-50 mmf, 350 WV | 917 1038 00 |
| C-121 | L-107 padding | CAPACITOR: mica, 220 mmf ±2%, 500 WV | 912 0517 00 |
| C-122 | L-108 trimming | CAPACITOR: variable ceramic, 5-25 mmf, 350 WV | 917 1036 00 |
| C-123 | L-108 padding | CAPACITOR: mica, 75 mmf ±5%, 500 WV | 912 0485 00 |
| C-124 | L-109 trimming | CAPACITOR: variable ceramic, 5-25 mmf, 350 WV | 917 1036 00 |
| C-125 | | CAPACITOR: Not used | |
| C-126 | V-101 plate bypass | CAPACITOR: ceramic, 10,000 mmf, 350 WV | 913 0566 00 |
| C-127 | L-111 padding | CAPACITOR: mica, 220 mmf ±2%, 500 WV | 912 0517 00 |
| C-128 | L-111 trimming | CAPACITOR: variable ceramic, 8-50 mmf, 350 WV | 917 1038 00 |
| C-129 | L-112 padding | CAPACITOR: mica, 75 mmf ±5%, 500 WV | 912 0485 00 |
| C-130 | L-112 trimming | CAPACITOR: variable ceramic, 5-25 mmf, 350 WV | 917 1036 00 |
| C-131 | | CAPACITOR: Not used | |
| C-132 | L-113 trimming | CAPACITOR: variable ceramic, 5-25 mmf, 350 WV | 917 1036 00 |
| C-133 | V-102 grid coupling, bands 4 and 7 | CAPACITOR: ceramic, 1.5 mmf ± 1/4 mmf, 500 WV | 916 4370 00 |
| C-134 | V-102 cathode bypass | CAPACITOR: ceramic, 10,000 mmf, 350 WV | 913 0566 00 |
| C-135 | V-102 screen bypass | CAPACITOR: ceramic, 10,000 mmf, 350 WV | 913 0566 00 |
| C-136 | V-102 injection coupling | CAPACITOR: mica, 100 mmf ±5%, 500 WV | 912 0494 00 |

| ITEM | CIRCUIT FUNCTION | DESCRIPTION | COLLINS PART NUMBER |
|---|---|---|---|
| C-137 | L-114 to L-115 coupling | CAPACITOR: ceramic, 10,000 mmf, 350 WV | 913 0566 00 |
| C-138 | V-102 plate bypass | CAPACITOR: ceramic, 10,000 mmf, 350 WV | 913 0566 00 |
| C-139 | L-115 padding | CAPACITOR: ceramic, 20 mmf ±5%, 500 WV | 916 4420 00 |
| C-140 | L-115 trimming | CAPACITOR: variable ceramic, 8-50 mmf, 350 WV | 917 1038 00 |
| C-141 | V-103 cathode bypass | CAPACITOR: ceramic, 10,000 mmf, 350 WV | 913 0566 00 |
| C-142 | V-103 screen bypass | CAPACITOR: ceramic, 10,000 mmf, 350 WV | 913 0566 00 |
| C-143 | V-103 injection coupling | CAPACITOR: mica, 100 mmf ±5%, 500 WV | 912 0494 00 |
| C-144 | L-121 trimming | CAPACITOR: variable ceramic, 8-50 mmf, 350 WV | 917 1038 00 |
| C-145 | L-121 padding | CAPACITOR: mica, 150 mmf ±5%, 500 WV | 912 0506 00 |
| C-146 | Bands 29, 30 harmonic tuning | CAPACITOR: variable ceramic, 5-25 mmf, 350 WV | 917 1036 00 |
| C-147 | Bands 27, 28 harmonic tuning | CAPACITOR: variable ceramic, 5-25 mmf, 350 WV | 917 1036 00 |
| C-148 | Bands 25, 26 harmonic tuning | CAPACITOR: variable ceramic, 5-25 mmf, 350 WV | 917 1036 00 |
| C-149 | Bands 23, 24 harmonic tuning | CAPACITOR: variable ceramic, 5-25 mmf, 350 WV | 917 1036 00 |
| C-150 | Bands 21, 22 harmonic tuning | CAPACITOR: variable ceramic, 8-50 mmf, 350 WV | 917 1038 00 |
| C-151 | Bands 23, 24 harmonic tuning | CAPACITOR: ceramic, 15 mmf ±5%, 500 WV | 916 4412 00 |
| C-152 | Bands 12, 20 harmonic tuning | CAPACITOR: variable ceramic, 8-50 mmf, 350 WV | 917 1038 00 |

| ITEM | CIRCUIT FUNCTION | DESCRIPTION | COLLINS PART NUMBER |
|---|---|---|---|
| C-153 | Bands 17, 18 harmonic tuning | CAPACITOR: ceramic, 36 mmf ±5%, 500 WV | 916 4448 00 |
| C-154 | Bands 17, 18 harmonic tuning | CAPACITOR: variable ceramic, 8-50 mmf, 350 WV | 917 1038 00 |
| C-155 | Bands 15, 16 harmonic tuning | CAPACITOR: ceramic, 47 mmf ±5%, 500 WV | 916 4463 00 |
| C-156 | Bands 15, 16 harmonic tuning | CAPACITOR: variable ceramic, 8-50 mmf, 350 WV | 917 1038 00 |
| C-157 | Bands 13, 14 harmonic tuning | CAPACITOR: ceramic, 68 mmf ±5%, 500 WV | 916 4309 00 |
| C-158 | Bands 13, 14 harmonic tuning | CAPACITOR: variable ceramic, 8-50 mmf, 350 WV | 917 1038 00 |
| C-159 | Spurious filter tuning | CAPACITOR: mica, 150 mmf ±5%, 500 WV | 912 0506 00 |
| C-160 | | CAPACITOR: Not used | |
| C-161 | Band 1 harmonic tuning | CAPACITOR: mica, 200 mmf ±2%, 500 WV | 912 0514 00 |
| C-162 | Band 1 harmonic tuning | CAPACITOR: variable ceramic, 8-50 mmf, 350 WV | 917 1038 00 |
| C-163 | V-105 plate bypass | CAPACITOR: ceramic, 10,000 mmf, 350 WV | 913 0566 00 |
| C-164 | V-105 screen bypass | CAPACITOR: ceramic, 10,000 mmf, 350 WV | 913 0566 00 |
| C-165 | Osc. feedback network | CAPACITOR: ceramic, 15 mmf ±5%, 500 WV | 916 4412 00 |
| C-166 | Osc. feedback network | CAPACITOR: mica, 100 mmf ±5%, 500 WV | 912 0494 00 |
| C-167 | Osc. grid circuit trimmer | CAPACITOR: variable ceramic, 3-12 mmf, 350 WV | 917 1035 00 |
| C-168 | | CAPACITOR: mica, 220 mmf ±2%, 500 WV | 912 0517 00 |
| C-169 | Freq. standard adjusting | CAPACITOR: variable ceramic, 5-25 mmf, 350 WV | 917 1036 00 |
| C-170 | V-104 cathode bypass | CAPACITOR: ceramic, 10,000 mmf, 350 WV | 913 0566 00 |
| C-171 | V-104 screen bypass | CAPACITOR: mica, 100 mmf ±5%, 500 WV | 912 0494 00 |

| ITEM | CIRCUIT FUNCTION | DESCRIPTION | COLLINS PART NUMBER |
|---|---|---|---|
| C-172 | V-104 plate decoupling | CAPACITOR: ceramic, 10,000 mmf, 350 WV | 913 0566 00 |
| C-173 | Freq. standard coupling | CAPACITOR: ceramic, 10 mmf ±1 mmf, 500 WV | 916 4406 00 |
| C-174 | L-116 trimming | CAPACITOR: variable ceramic, 8-50 mmf, 350 WV | 917 1038 00 |
| C-175 | L-116 padding | CAPACITOR: mica, 180 mmf ±2%, 500 WV | 912 0511 00 |
| C-176 | L-117 trimming | CAPACITOR: variable ceramic, 8-50 mmf, 350 WV | 917 1038 00 |
| C-177 | L-117 padding | CAPACITOR: mica, 300 mmf ±2%, 500 WV | 912 0526 00 |
| C-178 | V-103 plate bypass | CAPACITOR: ceramic, 10,000 mmf 350 WV | 913 0566 00 |
| C-179 | L-118 padding | CAPACITOR: mica, 180 mmf ±2%, 500 WV | 912 0511 00 |
| C-180 | L-118 trimming | CAPACITOR: variable ceramic, 8-50 mmf, 350 WV | 917 1038 00 |
| C-181 | L-119 padding | CAPACITOR: mica, 300 mmf ±2%, 500 WV | 912 0526 00 |
| C-182 | L-119 trimming | CAPACITOR: variable ceramic, 8-50 mmf, 350 WV | 917 1038 00 |
| C-183 | V-106 cathode bypass | CAPACITOR: ceramic, 10,000 mmf, 350 WV | 913 0566 00 |
| C-184 | V-106 grid bypass | CAPACITOR: mica, 100 mmf ±5%, 500 WV | 912 0494 00 |
| C-185 | V-106 screen bypass | CAPACITOR: ceramic, 10,000 mmf, 350 WV | 913 0566 00 |
| C-186 | V-106 plate bypass | CAPACITOR: ceramic, 10,000 mmf, 350 WV | 913 0566 00 |
| C-187 | Filter crystal parallel | CAPACITOR: ceramic, 10 mmf ±1 mmf, 500 WV | 916 4406 00 |
| C-188 | Filter crystal phasing | CAPACITOR: variable air, midget, single section, 3.5 -27 mmf | 922 0079 00 |
| C-189 | V-107 grid decoupling | CAPACITOR: ceramic, 10,000 mmf, 350 WV | 913 0566 00 |
| C-190 | V-107 screen bypass | CAPACITOR: ceramic, 10,000 mmf, 350 WV | 913 0566 00 |

| ITEM | CIRCUIT FUNCTION | DESCRIPTION | COLLINS PART NUMBER |
|---|---|---|---|
| C-191 | V-107 plate bypass | CAPACITOR: ceramic, 10,000 mmf, 350 WV | 913 0566 00 |
| C-192 | T-103 top coupling | CAPACITOR: ceramic, 2.0 mmf ±1/4 mmf, 500 WV | 916 4373 00 |
| C-193 | V-108 grid decoupling | CAPACITOR: ceramic, 10,000 mmf, 350 WV | 913 0566 00 |
| C-194 | V-108 screen bypass | CAPACITOR: ceramic, 10,000 mmf, 350 WV | 913 0566 00 |
| C-195 | V-108 plate bypass | CAPACITOR: ceramic, 10,000 mmf, 350 WV | 913 0566 00 |
| C-196 | T-104 top coupling | CAPACITOR: ceramic, 2.0 mmf ±1/4 mmf, 500 WV | 916 4373 00 |
| C-197 | V-109 grid decoupling | CAPACITOR: ceramic, 10,000 mmf, 350 WV | 913 0566 00 |
| C-198 | V-109 cathode bypass | CAPACITOR: paper, 0-1 -0.1 mf +20%, -10%, 600 WV | 961 5169 00 |
| C-199 | V-109 screen bypass | CAPACITOR: ceramic, 10,000 mmf, 350 WV | 913 0566 00 |
| C-200 | V-109 plate bypass | CAPACITOR: ceramic, 10,000 mmf, 350 WV | 913 0566 00 |
| C-201 | V-105 top coupling | CAPACITOR: ceramic, 2.0 mmf ±1/4 mmf, 500 WV | 916 4373 00 |
| C-202 | Detector filter | CAPACITOR: mica, 330 mmf ±2%, 500 WV | 912 0529 00 |
| C-203 | | CAPACITOR: Not used | |
| C-204 | AVC rectifier coupling | CAPACITOR: mica, 100 mmf ±5%, 500 WV | 912 0494 00 |
| C-205 | A. Back bias r-f filter<br>B. AVC amplr. stabilizing<br>C. Noise limiter filter | CAPACITOR: paper, 0.1-0.1-0.1 mmf +20% -10%, 600 WV | 961 5187 00 |
| C-206 | BFO coupling | CAPACITOR: mica, 5 mmf ±5%, 500 WV | 912 0428 00 |
| C-207 | Line filter | CAPACITOR: ceramic, 10,000 mmf, 350 WV | 913 0566 00 |
| C-208 | AVC amplr. stabilizing | CAPACITOR: ceramic, 10,000 mmf, 350 WV | 913 0566 00 |

| ITEM | CIRCUIT FUNCTION | DESCRIPTION | COLLINS PART NUMBER |
|---|---|---|---|
| C-209 | Audio coupling | CAPACITOR: ceramic, 10,000 mmf, 350 WV | 913 0566 00 |
| C-210 | | CAPACITOR: Not used | |
| C-211 | Audio coupling | CAPACITOR: ceramic, 10,000 mmf, 350 WV | 913 0566 00 |
| C-212 | Audio output equalizer | CAPACITOR: mica 6,800 mmf ±10%, 300 WV | 935 2110 00 |
| C-213 | AVC time constant | CAPACITOR: ceramic, 10,000 mmf, 350 WV | 913 0566 00 |
| C-214 | K-101 noise filter | CAPACITOR: paper, 0.1-0.1 mf +20% -10%, 600 WV | 961 4175 00 |
| C-215 | V-111 cathode bypass | CAPACITOR: dry electrolytic, 20 mf 150 WV | 184 6509 00 |
| C-216 | Back bias filter | CAPACITOR: dry electrolytic, 20 mf 150 WV | 184 6509 00 |
| C-217 | Power supply filter | CAPACITOR: dry electrolytic, dual section; 35 mf each section -10% +25%, 450 WV | 184 5000 00 |
| C-218 | V-114 screen bypass | CAPACITOR: ceramic, 10,000 mmf, 350 WV | 913 0566 00 |
| C-219 | V-114 screen decoupling | CAPACITOR: ceramic, 10,000 mmf, 350 WV | 913 0566 00 |
| C-220 | L-116, L-118 top coupling | CAPACITOR: ceramic, 4.0 mmf ±1/4 mmf, 500 WV | 916 4380 00 |
| C-221 | L-117, L-119 top coupling | CAPACITOR: ceramic, 2.0 mmf ±1/4 mmf, 500 WV | 916 4373 00 |
| C-222 | | CAPACITOR: Not used | |
| C-223 | B+ isolation capacitor | CAPACITOR: dry electrolytic, 8 mf, 350 WV | 184 6515 00 |
| C-224 | Cal. osc. adjustment | CAPACITOR: variable air, 7-100 mmf | 922 0153 00 |
| C-225 | | CAPACITOR: Not used | |
| C-226 | V-111B grid coupling | CAPACITOR: mica, 100 mmf ±5%, 500 WV | 912 0494 00 |
| C-227 | V-111B plate bypass | CAPACITOR: ceramic, 10,000 mmf, 350 WV | 913 0566 00 |

| ITEM | CIRCUIT FUNCTION | DESCRIPTION | COLLINS PART NUMBER |
|---|---|---|---|
| C-228 | IF output coupling | CAPACITOR: ceramic, 10,000 mmf 350 WV | 913 0566 00 |
| C-229 | | CAPACITOR: Not used | |
| C-230 | Antenna trimmer, all bands | CAPACITOR: variable air, 7-100 mmf | 922 0153 00 |
| C-231 | Antenna fixed trimmer, bands 8-15 | CAPACITOR: ceramic, 100 mmf ±5%, 500 WV | 916 4059 00 |
| C-232 | Antenna fixed trimmer, bands 16-30 | CAPACITOR: ceramic, 24 mmf ±5%, 500 WV | 916 4428 00 |
| C-233 | Antenna coupling, band 1 | CAPACITOR: ceramic, 100 mmf ±5%, 500 WV | 916 4059 00 |
| C-234 | Antenna coupling, band 2 | CAPACITOR: ceramic, 51 mmf ±5%, 500 WV | 916 4294 00 |
| C-235 | Antenna coupling, band 3 | CAPACITOR: ceramic, 36 mmf ±5%, 500 WV | 916 4448 00 |
| C-236 | Antenna coupling, bands 4-7 | CAPACITOR: ceramic, 22 mmf ±5%, 500 WV | 916 4424 00 |
| C-237 | Antenna coupling, bands 8-15 | CAPACITOR: ceramic, 10 mmf ±1 mmf, 500 WV | 916 4406 00 |
| C-238 | Antenna coupling, bands 16-30 | CAPACITOR: ceramic, 5 mmf ±1/2 mmf, 500 WV | 916 4385 00 |
| CR-101 | M-101 rectifier | RECTIFIER: dry disc, instrument type | 353 3000 00 |
| E-101 | K-101 term bd. | | |
| E-102 | Audio output term. bd. | | |
| F-101 | Primary power fuse | FUSE: cartridge, 1.5 amp, one time | 264 0007 00 |
| I-101 | Dial light | LAMP: pilot light, miniature bayonet base bulb, T-3-1/4 bulb | 262 3240 00 |
| I-102 | Dial light | LAMP: pilot light, miniature bayonet base bulb, T-3-1/4 bulb | 262 3240 00 |

| ITEM | CIRCUIT FUNCTION | DESCRIPTION | COLLINS PART NUMBER |
|---|---|---|---|
| I-103 | Dial light | LAMP: pilot light, miniature bayonet base bulb, T-3-1/4 bulb | 262 3240 00 |
| I-104 | Static discharge | LAMP: glow, bayonet candelabra base, T-4-1/2 bulb | 262 0238 00 |
| I-105 | Band drum | DIAL: band indicating drum | 504 3097 00 |
| J-101 | Antenna input | CONNECTOR: receptacle, single round female contact | 357 9005 00 |
| J-102 | Speaker output | JACK: telephone, 3 circuit, for use with .206" diam plug | 358 1050 00 |
| J-103 | Phone output | JACK: telephone, 2 circuit, for use with .206" diam plug | 358 1040 00 |
| J-104 | I-F output | CONNECTOR: receptacle, single round female contact | 357 9005 00 |
| K-101 | Break-in relay | RELAY: armature, contact rating 3 ampere 150 watt, 12 volts, .021 amp direct current | 972 1176 00 |
| L-101 | Antenna coil, band 1 | COIL ASSEMBLY: RF, single winding, 75 turns, single layer wound | 504 3056 001 |
| L-102 | Antenna coil, band 2 | COIL: RF, single layer wound, 48 turns #28 enameled wire | 505 2147 002 |
| L-103 | Antenna coil, band 3 | COIL: RF, single layer wound, 43 turns #28 enameled wire | 505 2148 002 |
| L-104 | Antenna coil, bands 4-7 | COIL ASSEMBLY: RF, single winding, 27 turns single layer wound | 504 3060 001 |
| L-105 | Antenna coil, bands 8-15 | COIL ASSEMBLY: RF, single winding, 20 turns, single layer wound | 504 3061 001 |
| L-106 | Antenna coil, bands 16-30 | COIL ASSEMBLY: RF, single winding, 20 turns, single layer wound | 504 3062 001 |
| L-107 | Mixer coil pri., bands 4-7 | COIL ASSEMBLY: RF, single winding, 27 turns, single layer wound | 504 3060 001 |

| ITEM | CIRCUIT FUNCTION | DESCRIPTION | COLLINS PART NUMBER |
|---|---|---|---|
| L-108 | Mixer coil pri., bands 8-15 | COIL ASSEMBLY: RF, single winding, 20 turns, single layer wound | 504 3061 001 |
| L-109 | Mixer coil pri, bands 16-30 | COIL ASSEMBLY: RF, single winding, 20 turns, single layer wound | 504 3062 001 |
| L-110 | Mixer coil, band 1 | COIL ASSEMBLY: RF, single winding, 75 turns, single layer wound | 504 3056 001 |
| L-111 | Mixer coil sec, bands 4-7 | COIL ASSEMBLY: RF, single winding, 27 turns, single layer wound | 504 3060 001 |
| L-112 | Mixer coil sec, bands 8-15 | COIL ASSEMBLY: RF, single winding, 20 turns, single layer wound | 504 3061 001 |
| L-113 | Mixer coil sec, bands 16-30 | COIL ASSEMBLY: RF, single winding, 20 turns, single layer wound | 504 3062 001 |
| L-114 | 11.5-10.5 mc i-f coil, band 1 | COIL: IF, transformer, single winding, 48 turns, single layer wound | 504 3064 001 |
| L-115 | 11.5-10.5 mc i-f coil, band 1 | COIL: IF, transformer, single winding, 16 turns, single layer wound | 504 3057 001 |
| L-116 | Variable i-f coil pri. | COIL: IF, transformer, single winding, 48 turns, single layer wound | 504 3064 001 |
| L-117 | Variable i-f coil pri. | COIL: IF, transformer, single winding, 46 turns, universal wound | 504 3066 001 |
| L-118 | Variable i-f coil sec. | COIL: IF, transformer, single winding, 48 turns, single layer wound | 504 5347 001 |
| L-119 | Variable i-f coil sec. | COIL: IF, transformer, single winding, 46 turns, universal wound | 504 3066 001 |
| L-120 | Inj. osc. cathode coil | COIL: RF, 3 windings, 112 turns, universal wound | 503 4535 001 |
| L-121 | Inj. osc. harmonic selector | COIL: RF, single winding, 46 turns, single layer wound | 504 3074 002 |

| ITEM | CIRCUIT FUNCTION | DESCRIPTION | COLLINS PART NUMBER |
|---|---|---|---|
| L-122 | Power filter | REACTOR: filter choke, 3.0 hy 120 ma, 100 ohm, 250 TV RMS | 678 0432 00 |
| L-123 | Power filter | REACTOR: filter choke, 5 hy 80 ma, 300 ohm, 2500 TV RMS | 678 0431 00 |
| L-124 | Spurious filter | FILTER: band supression, rejection frequency 4 megacycles, .260" diam hole for mounting | 504 6646 002 |
| L-125 | Spurious filter | COIL: RF, choke, 500 millihenry ± 10%, #36 wire | 240 0073 00 |
| M-101 | Signal level & db meter | METER: audio level, 0-1 ma 46 ohms ±10% | 476 9017 00 |
| P-101 | AC plug | CONNECTOR: plug, 2 parallel blade male contacts | 368 0040 00 |
| R-101 | V-101 grid return | RESISTOR: 1 megohm ±10%, 1/2 w | 745 1212 00 |
| R-102 | V-101 grid decoupling | RESISTOR: .10 megohm ±10%, 1/2 w | 745 1170 00 |
| R-103 | | RESISTOR: Not used | |
| R-104 | V-101 screen dropping | RESISTOR: 33,000 ohm ±10%, 1/2 w | 745 1149 00 |
| R-105 | V-101 plate load, band 1 | RESISTOR: 10,000 ohm ±10%, 1/2 w | 745 1128 00 |
| R-106 | V-101 plate decoupling | RESISTOR: 6800 ohm ±10%, 1/2 w | 745 1121 00 |
| R-107 | V-102 cathode | RESISTOR: 470 ohm ±10%, 1/2 w | 745 1072 00 |
| R-108 | V-102 grid 1 return | RESISTOR: .33 megohm ±10%, 1/2 w | 745 1191 00 |
| R-109 | V-102 screen dropping | RESISTOR: 47,000 ohm ±10%, 1/2 w | 745 1156 00 |
| R-110 | V-102 plate decoupling | RESISTOR: 2200 ohm ±10%, 1/2 w | 745 1100 00 |
| R-111 | V-103 cathode | RESISTOR: 470 ohm ±10%, 1/2 w | 745 1072 00 |
| R-112 | V-103 grid 1 return | RESISTOR: .10 megohm ±10%, 1/2 w | 745 1170 00 |
| R-113 | V-103 screen dropping | RESISTOR: 33,000 ohm ±10%, 1/2 w | 745 1149 00 |

| ITEM | CIRCUIT FUNCTION | DESCRIPTION | COLLINS PART NUMBER |
|---|---|---|---|
| R-114 | V-105 screen dropping | RESISTOR: 33,000 ohm ±10%, 1/2 w | 745 1149 00 |
| R-115 | V-105 grid leak | RESISTOR: .10 megohm ±10%, 1/2 w | 745 1170 00 |
| R-116 | V-103 plate load | RESISTOR: 2200 ohm ±10%, 1/2 w | 745 1100 00 |
| R-117 | V-103 plate load | RESISTOR: 47,000 ohm ±10%, 1/2 w | 745 1156 00 |
| R-118 | V-104 grid leak | RESISTOR: .68 megohm ±10%, 1/2 w | 745 1205 00 |
| R-119 | V-104 cathode | RESISTOR: 4700 ohm ±10%, 1/2 w | 745 1114 00 |
| R-120 | V-104 screen dropping | RESISTOR: .10 megohm ±10%, 1/2 w | 745 1170 00 |
| R-121 | V-104 plate dropping | RESISTOR: .22 megohm ±10%, 1/2 w | 745 1184 00 |
| R-122 | V-104 plate, screen decoupling | RESISTOR: 10,000 ohm ±10%, 1/2 w | 745 1128 00 |
| R-123 | VFO plate, screen decoupling | RESISTOR: .10 megohm ±10%, 1/2 w | 745 1170 00 |
| R-124 | V-103 plate decoupling | RESISTOR: 2200 ohm ±10%, 1/2 w | 745 1100 00 |
| R-125 | V-107 grid load | RESISTOR: .47 megohm ±10%, 1/2 w | 745 1198 00 |
| R-126 | V-107 screen dropping | RESISTOR: 27,000 ohm ±10%, 1/2 w | 745 1146 00 |
| R-127 | V-106 cathode | RESISTOR: 470 ohm ±10%, 1/2 w | 745 1072 00 |
| R-128 | V-106 screen dropping | RESISTOR: 33,000 ohm ±10%, 1/2 w | 745 1149 00 |
| R-129 | V-106 plate decoupling | RESISTOR: 2200 ohm ±10%, 1/2 w | 745 1100 00 |
| R-130 | Crystal filter selectivity | RESISTOR: .10 megohm ±10%, 1/2 w | 745 1170 00 |
| R-131 | Crystal filter selectivity | RESISTOR: 22,000 ohm ±10%, 1/2 w | 745 1142 00 |
| R-132 | Crystal filter selectivity | RESISTOR: 4700 ohm ±10%, 1/2 w | 745 1114 00 |
| R-133 | V-107 grid decoupling | RESISTOR: 10,000 ohm ±10%, 1/2 w | 745 1128 00 |
| R-134 | V-107 screen dropping | RESISTOR: 47,000 ohm ±10%, 1/2 w | 745 1156 00 |

| ITEM | CIRCUIT FUNCTION | DESCRIPTION | COLLINS PART NUMBER |
|---|---|---|---|
| R-135 | V-107 plate decoupling | RESISTOR: 2200 ohm ±10%, 1/2 w | 745 1100 00 |
| R-136 | V-108 grid decoupling | RESISTOR: 10,000 ohm ±10%, 1/2 w | 745 1128 00 |
| R-137 | V-108 screen dropping | RESISTOR: 47,000 ohm ±10%, 1/2 w | 745 1156 00 |
| R-138 | V-108 plate decoupling | RESISTOR: 2200 ohm ±10%, 1/2 w | 745 1100 00 |
| R-139 | V-109 grid decoupling | RESISTOR: 10,000 ohm ±10%, 1/2 w | 745 1128 00 |
| R-140 | "S" meter zero adjust | RESISTOR: 100 ohm ±20%, 2 w | 380 0120 00 |
| R-141 | V-109 screen dropping | RESISTOR: 47,000 ohm ±10%, 1/2 w | 745 1156 00 |
| R-142 | V-109 plate decoupling | RESISTOR: 2200 ohm ±10%, 1 w | 745 3100 00 |
| R-143 | V-112 filament series | RESISTOR: 10 ohm ±10%, 1/2 w | 745 1002 00 |
| R-144 | AVC amplr stabilizing | RESISTOR: .47 megohm ±10%, 1/2 w | 745 1198 00 |
| R-145 | AVC rectifier load | RESISTOR: .10 megohm ±10%, 1/2 w | 745 1170 00 |
| R-146 | AVC amplr load | RESISTOR: 47,000 ohm ±10%, 1/2 w | 745 1156 00 |
| R-147 | AVC amplr plate dropping | RESISTOR: 27,000 ohm ±10%, 1/2 w | 745 1146 00 |
| R-148 | RF gain control | RESISTOR: 10,000 ohm ±20%, 2 w | 380 0118 00 |
| R-149 | RF gain control, fixed | RESISTOR: 820 ohm ±10%, 1/2 w | 745 1083 00 |
| R-150 | Detector load | RESISTOR: 68,000 ohm ±10%, 1/2 w | 745 1163 00 |
| R-151 | Detector load | RESISTOR: 33,000 ohm ±10%, 1/2 w | 745 1149 00 |
| R-152 | Limiter filter | RESISTOR: .47 megohm ±10%, 1/2 w | 745 1198 00 |
| R-153 | Limiter filter | RESISTOR: .47 megohm ±10%, 1/2 w | 745 1198 00 |
| R-154 | Audio gain control | RESISTOR: 500,000 ohm ±20%, 2 w | 380 0119 00 |
| R-155 | V-112B cathode | RESISTOR: 3300 ohm ±10%, 1/2 w | 745 1107 00 |
| R-156 | V-112B plate load | RESISTOR: .22 megohm ±10%, 1/2 w | 745 1184 00 |
| R-157 | V-113 grid load | RESISTOR: .10 megohm ±10%, 1/2 w | 745 1170 00 |

| ITEM | CIRCUIT FUNCTION | DESCRIPTION | COLLINS PART NUMBER |
|---|---|---|---|
| R-158 | T-103 pri shunt | RESISTOR: .22 megohm ±10%, 1/2 w | 745 1184 00 |
| R-159 | T-103 sec shunt | RESISTOR: .22 megohm ±10%, 1/2 w | 745 1184 00 |
| R-160 | V-114 screen dropping | RESISTOR: .10 megohm ±10%, 1/2 w | 745 1170 00 |
| R-161 | V-114 plate load | RESISTOR: 33,000 ohm ±10%, 1/2 w | 745 1149 00 |
| R-162 | V-114 plate dropping | RESISTOR: 2200 ohm ±10%, 1/2 w | 745 1100 00 |
| R-163 | "S" meter series | RESISTOR: 160 ohm ±5%, 1/2 w | 745 1053 00 |
| R-164 | Back bias dropping | RESISTOR: wire-wound, 120 ohm ±5%, 8 w | 747 0032 00 |
| R-165 | Back bias dropping | RESISTOR: wire-wound, 310 ohm ±5%, 8 w | 747 0036 00 |
| R-166 | Back bias dropping | RESISTOR: wire-wound, 120 ohm ±5%, 8 w | 747 0032 00 |
| R-167 | AVC amplr stabilizing | RESISTOR: .10 megohm ±10%, 1/2 w | 745 1170 00 |
| R-168 | V-111A cathode | RESISTOR: 2200 ohm ±10%, 1/2 w | 745 1100 00 |
| R-169 | V-108 screen dropping | RESISTOR: 27,000 ohm ±10%, 1/2 w | 745 1146 00 |
| R-170 | "S" meter bridge | RESISTOR: 100 ohm ±10%, 1/2 w | 745 1044 00 |
| R-171 | AVC amplr stabilizing | RESISTOR: 120,000 ohm ±10%, 1/2 w | 745 1174 00 |
| R-172 | Static drain | RESISTOR: .47 megohm ±10%, 1/2 w | 745 1198 00 |
| R-173 | Audio voltage dropping | RESISTOR: 2200 ohm ±10%, 1/2 w | 745 1100 00 |
| R-174 | B+ isolation | RESISTOR: 1000 ohm ±10%, 2 w | 745 5086 00 |
| R-175 | | RESISTOR: Not used | |
| R-176 | | RESISTOR: Not used | |
| R-177 | V-111B grid | RESISTOR: .22 megohm ±10%, 1/2 w | 745 1184 00 |
| R-178 | V-111B grid | RESISTOR: .10 megohm ±10%, 1/2 w | 745 1170 00 |

| ITEM | CIRCUIT FUNCTION | DESCRIPTION | COLLINS PART NUMBER |
|---|---|---|---|
| R-179 | V-111B cathode | RESISTOR: 1000 ohm ±10%, 1/2 w | 745 1086 00 |
| R-180 | V-111B plate dropping | RESISTOR: 2200 ohm ±10%, 1/2 w | 745 1100 00 |
| R-181 | V-116 plate load | RESISTOR: 4000 ohm ±5%, 12 w | 747 1046 00 |
| S-101 | Antenna coil selector | SWITCH: rotary, 1 circuit, 17 position | 269 1271 00 |
| S-102 | Antenna trimmer selector | SWITCH: rotary, 1 circuit, 17 position | 269 1271 00 |
| S-103 | RF coil selector | SWITCH: rotary, 1 circuit, 18 position | 269 1273 00 |
| S-104 | RF amplr plate coil selector | SWITCH: rotary, 1 circuit, 18 position | 269 1273 00 |
| S-105 | Mixer grid coil selector | SWITCH: rotary, 1 circuit, 18 position | 269 1273 00 |
| S-106 | Mixer plate circuit selector | SWITCH: rotary, 1 circuit, 17 position | 269 1271 00 |
| S-107 | Mixer plate circuit selector | SWITCH: rotary, 1 circuit, 17 position | 269 1271 00 |
| S-108 | Inj osc harmonic selector | SWITCH: rotary, 2 circuit, 15 position | 269 1272 00 |
| S-109 | Crystal selector | SWITCH: rotary, 1 circuit, 17 position | 269 1271 00 |
| S-110 | Variable i-f selector | SWITCH: rotary, 1 circuit, 2 position | 269 1270 00 |
| S-111 | Variable i-f selector | SWITCH: rotary, 1 circuit, 2 position | 269 1270 00 |
| S-112 | BFO ON-OFF | SWITCH: rotary, 2 circuit, 2 position | 259 0380 00 |
| S-113 | ON-STANDBY-OFF | SWITCH: band change, 2 circuit, 3 position, shorting | 259 0381 00 |
| S-114 | SELECTIVITY | SWITCH: band change, 1 circuit, shorting, 5 position | 259 0379 00 |
| S-115 | AVC ON-OFF | SWITCH: rotary, 2 circuit, 2 position | 259 0380 00 |

| ITEM | CIRCUIT FUNCTION | DESCRIPTION | COLLINS PART NUMBER |
|---|---|---|---|
| S-116 | LIMITER IN-OUT | SWITCH: rotary, 2 circuit, 2 position | 259 0380 00 |
| S-117 | METER INPUT-OUTPUT | SWITCH: toggle, DPDT, 30 ampere continuous | 266 3062 00 |
| S-118 | CALIBRATE ON-OFF | SWITCH: rotary, 2 circuit, 2 position | 259 0380 00 |
| T-101 | Crystal filter input | TRANSFORMER: IF, frequency range 490 to 510 kc | 278 0093 00 |
| T-102 | Crystal filter output | FILTER: bandpass, frequency range 490 to 510 kc | 278 0092 00 |
| T-103 | First i-f | TRANSFORMER: IF, frequency 490 to 510 kc | 278 0090 00 |
| T-104 | Second i-f | TRANSFORMER: IF, frequency 490 to 510 kc | 278 0090 00 |
| T-105 | Third i-f | TRANSFORMER: IF, frequency 490 to 510 kc | 278 0090 00 |
| T-106 | BFO coil | OSCILLATOR SUBASSEMBLY: frequency range 480 to 520 kc | 278 0091 00 |
| T-107 | Audio output | TRANSFORMER: AF, line type, pri 5000 ohm, secd 600 ohm tapped at 4 ohms, 1500 TV, 3 w max | 677 0430 00 |
| T-108 | Power input | TRANSFORMER: power, pri 115 v, secd #1, 5 v, secd #2, 6.3 v, secd #3 700 v CT, 60 cps | 672 0429 00 |
| V-101 | RF amplr | TUBE: type 6AK5, pentode JAN<br>COMMERCIAL | 254 0121 00<br>257 0040 00 |
| V-102 | First Mixer | TUBE: type 6BE6, pentagrid JAN<br>COMMERCIAL | 254 0799 00<br>257 0048 00 |
| V-103 | Band 1 mixer | TUBE: type 6BE6, pentagrid JAN<br>COMMERCIAL | 254 0799 00<br>257 0048 00 |
| V-104 | Cal. osc. | TUBE: type 6BA6, pentode JAN<br>COMMERCIAL | 254 0787 00<br>255 0185 00 |
| V-105 | Inj. osc. | TUBE: type 6AK5, pentode JAN<br>COMMERCIAL | 254 0121 00<br>257 0040 00 |

| ITEM | CIRCUIT FUNCTION | DESCRIPTION | COLLINS PART NUMBER |
|---|---|---|---|
| V-106 | Second mixer | TUBE: type 6BE6, pentagrid ..... JAN<br>COMMERCIAL | 254 0799 00<br>257 0048 00 |
| V-107 | First i-f amplr. | TUBE: type 6BA6, pentode JAN<br>COMMERCIAL | 254 0787 00<br>255 0185 00 |
| V-108 | Second i-f amplr. | TUBE: type 6BA6, pentode JAN<br>COMMERCIAL | 254 0787 00<br>255 0185 00 |
| V-109 | Third i-f amplr. | TUBE: type 6BA6, pentode JAN<br>COMMERCIAL | 254 0787 00<br>255 0185 00 |
| V-110 | Detector & AVC rectifier | TUBE: type 12AX7, twin triode JAN<br>COMMERCIAL | 254 0790 00<br>255 0201 00 |
| V-111 | AVC amplr & IF output | TUBE: type 12AU7, twin triode JAN<br>COMMERCIAL | 254 0792 00<br>255 0199 00 |
| V-112 | Limiter & first audio amplr | TUBE: type 12AX7, twin triode JAN<br>COMMERCIAL | 254 0790 00<br>255 0201 00 |
| V-113 | Second audio amplr | TUBE: type 6AQ5, pentode JAN<br>COMMERCIAL | 254 0788 00<br>255 0195 00 |
| V-114 | BFO | TUBE: type 6BA6, pentode JAN<br>COMMERCIAL | 254 0787 00<br>255 0185 00 |
| V-115 | Power rectifier | TUBE: type 5V4G, rectifier JAN<br>COMMERCIAL | 254 0102 00<br>255 0081 00 |
| V-116 | Voltage regulator | TUBE: type 0A2, voltage regulator<br>JAN<br>COMMERCIAL | <br>254 0793 00<br>257 0052 00 |
| XF-101 | Holder for F-101 | HOLDER: fuse, extractor post for single 3AG fuse | 265 1003 00 |
| XI-101 | Socket for I-101 | SOCKET: lamp, pilot light bracket, miniature bayonet base | 262 0240 00 |
| XI-102 | Socket for I-102 | SOCKET: lamp, pilot light bracket, miniature bayonet base | 262 0240 00 |
| XI-103 | Socket for I-103 | SOCKET: lamp, pilot light assembly, miniature bayonet base | 262 0239 00 |

| ITEM | CIRCUIT FUNCTION | DESCRIPTION | COLLINS PART NUMBER |
|---|---|---|---|
| XV-101 thru XV-109 | Sockets for V-101, V-102, V-103, V-104, V-105, V-106, V-107, V-108, V-109 | SOCKET: tube, 7 contact miniature, shielded | 220 1111 00 |
| XV-110 | Socket for V-110 | SOCKET: tube, 9 contact miniature, shielded | 220 1103 00 |
| XV-111 | Socket for V-111 | SOCKET: tube, 9 contact miniature, shielded | 220 1103 00 |
| XV-112 | Socket for V-112 | SOCKET: tube 9 contact miniature, shielded | 220 1103 00 |
| XV-113 | Socket for V-113 | SOCKET: tube, 7 contact miniature, shielded | 220 1111 00 |
| XV-114 | Socket for V-114 | SOCKET: tube, 7 contact miniature, shielded | 220 1111 00 |
| XV-115 | Socket for V-115 | SOCKET: tube octal | 220 1121 00 |
| XV-116 | Socket for V-116 | SOCKET: tube 7 contact miniature, shielded | 220 1111 00 |
| XY-101 XY-110 | Socket for Y-101 thru Y-110 | BOARD: crystal, accommodates 10 type CR-18/U crystals | 504 5009 00 |
| XY-111 | Socket for Y-111 | SOCKET: crystal, for 100 kc crystal | 292 0055 00 |
| Y-101 | Bands 29-30 crystal | CRYSTAL: type CR-18/U, 10666.67 kc | 291 8134 00 |
| Y-102 | Bands 23-24 crystal | CRYSTAL: type CR-18/U, 13,000.000 kc | 291 8102 00 |
| Y-103 | Bands 19-20 crystal | CRYSTAL: type CR-18/U, 11,000.00 kc | 291 8114 00 |
| Y-104 | Bands 15-16 crystal | CRYSTAL: type CR-18/U, 9,000.00 kc | 291 8083 00 |
| Y-105 | Bands 11-12, 25-26 crystal | CRYSTAL: type CR-18/U, 14000.00 kc | 291 8135 00 |
| Y-106 | Bands 9-10, 21-22 crystal | CRYSTAL: type CR-18/U, 12,000.000 kc | 291 8117 00 |
| Y-107 | Bands 7-8, 17-18, 27-28 crystal | CRYSTAL: type CR-18/U, 10,000.00 kc | 291 8133 00 |

| ITEM | CIRCUIT FUNCTION | DESCRIPTION | COLLINS PART NUMBER |
|---|---|---|---|
| Y-108 | Bands 5-6, 13-14 crystal | CRYSTAL: type CR-18/U, 8000.000 kc | 291 8113 00 |
| Y-109 | Band 3 crystal | CRYSTAL: type CR-18/U, 6000.00 kc | 291 8132 00 |
| Y-110 | Band 1 crystal | CRYSTAL: type CR-18/U, 4000.000 kc | 291 8131 00 |
| Y-111 | Calibration crystal | CRYSTAL: special 100 kc unit | 291 5954 00 |
| Y-112 | Filter crystal | CRYSTAL: type CR-7, 500 kc | 291 5175 00 |
| 70E-15 | Variable frequency oscillator, 2-3 mc | This unit has been dehydrated and hermetically sealed, and should be returned to the Collins Radio Company, if servicing is required. | 505 0410 003 |

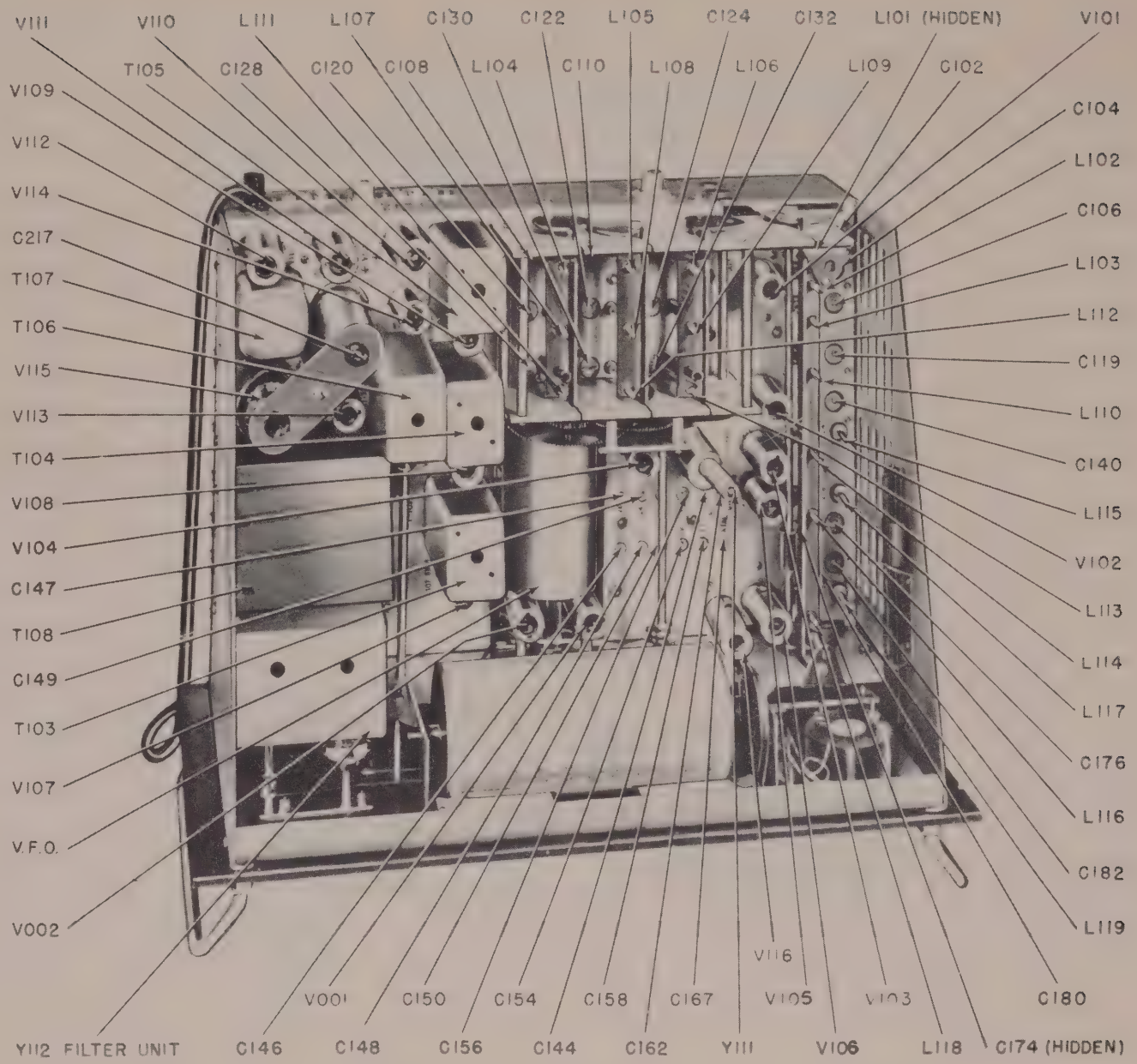



Figure 7-1. 51J-3 Top View

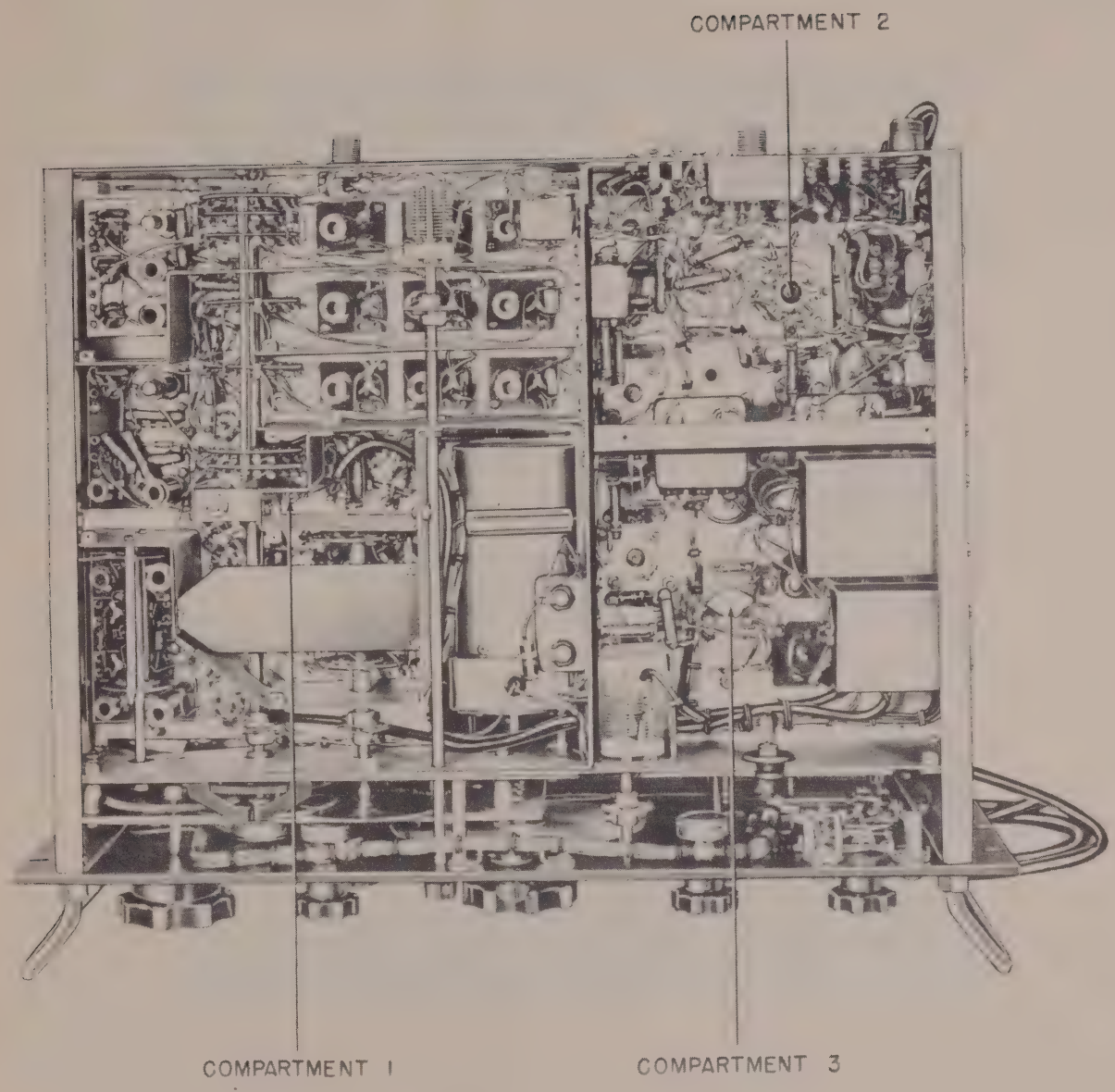



Figure 7-2. 51J-3 Bottom View

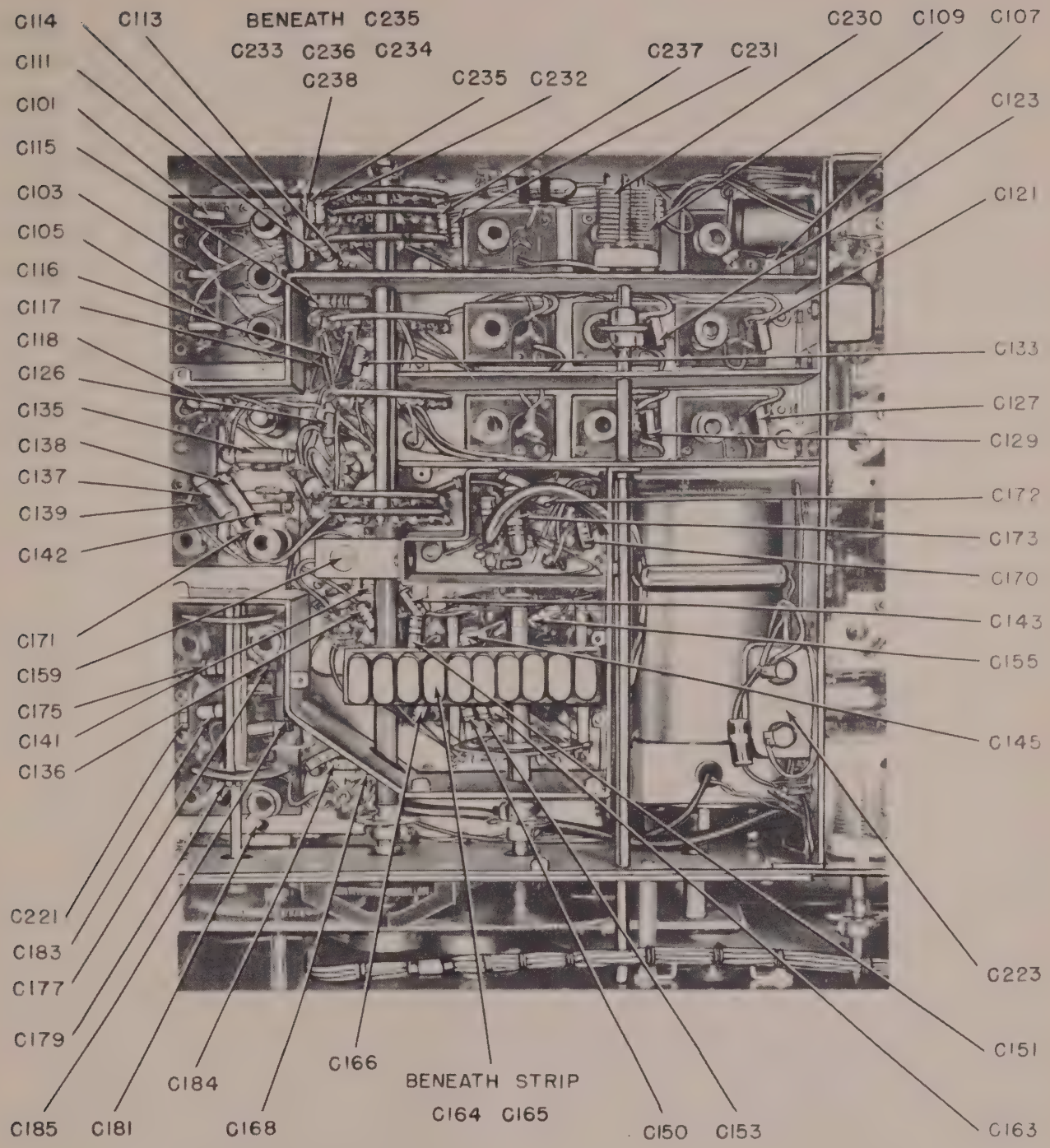



Figure 7-3. 51J-3 Bottom View, Compartment 1, Capacitor

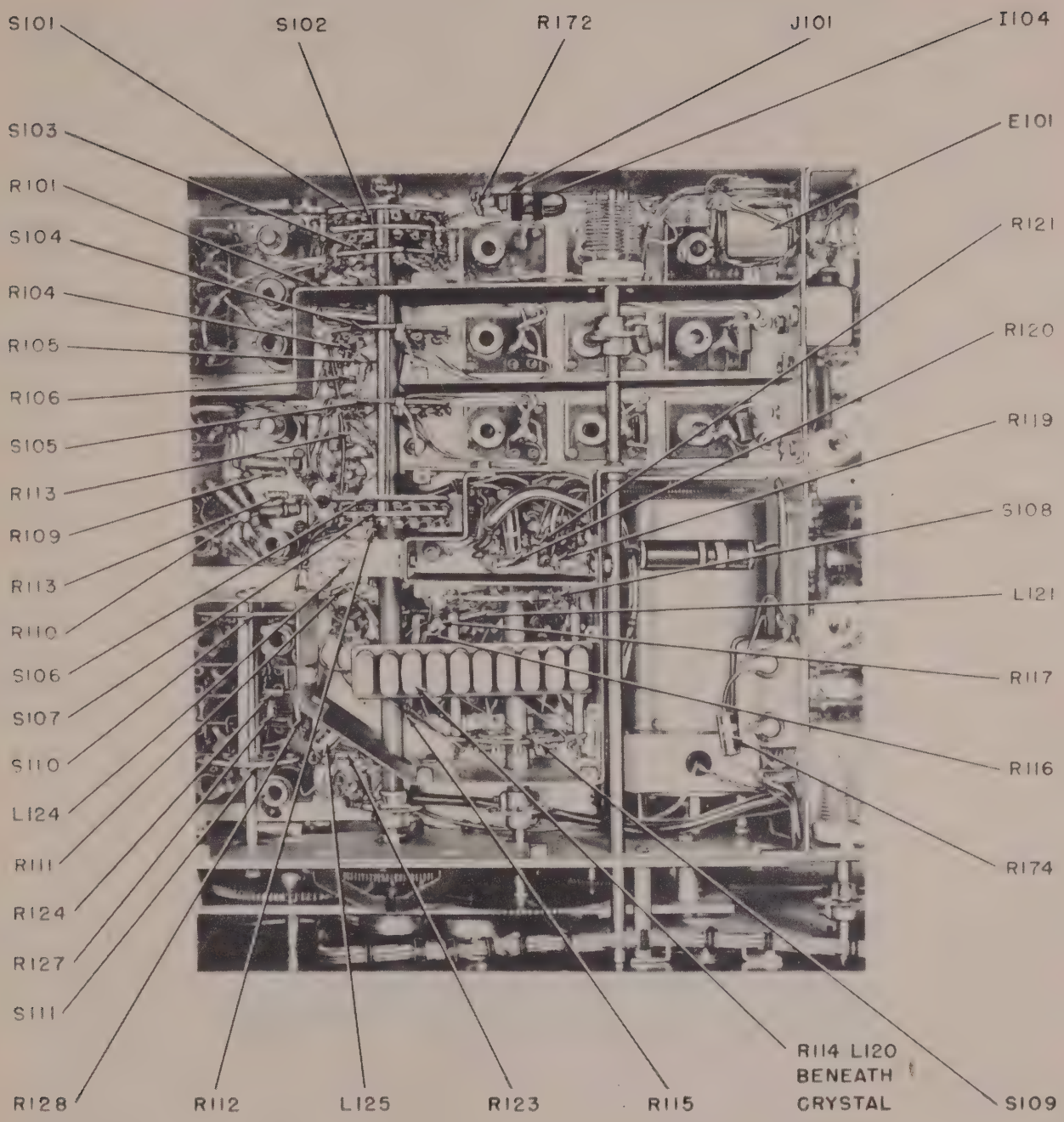



Figure 7-4. 51J-3 Bottom View, Compartment 1, Other Components

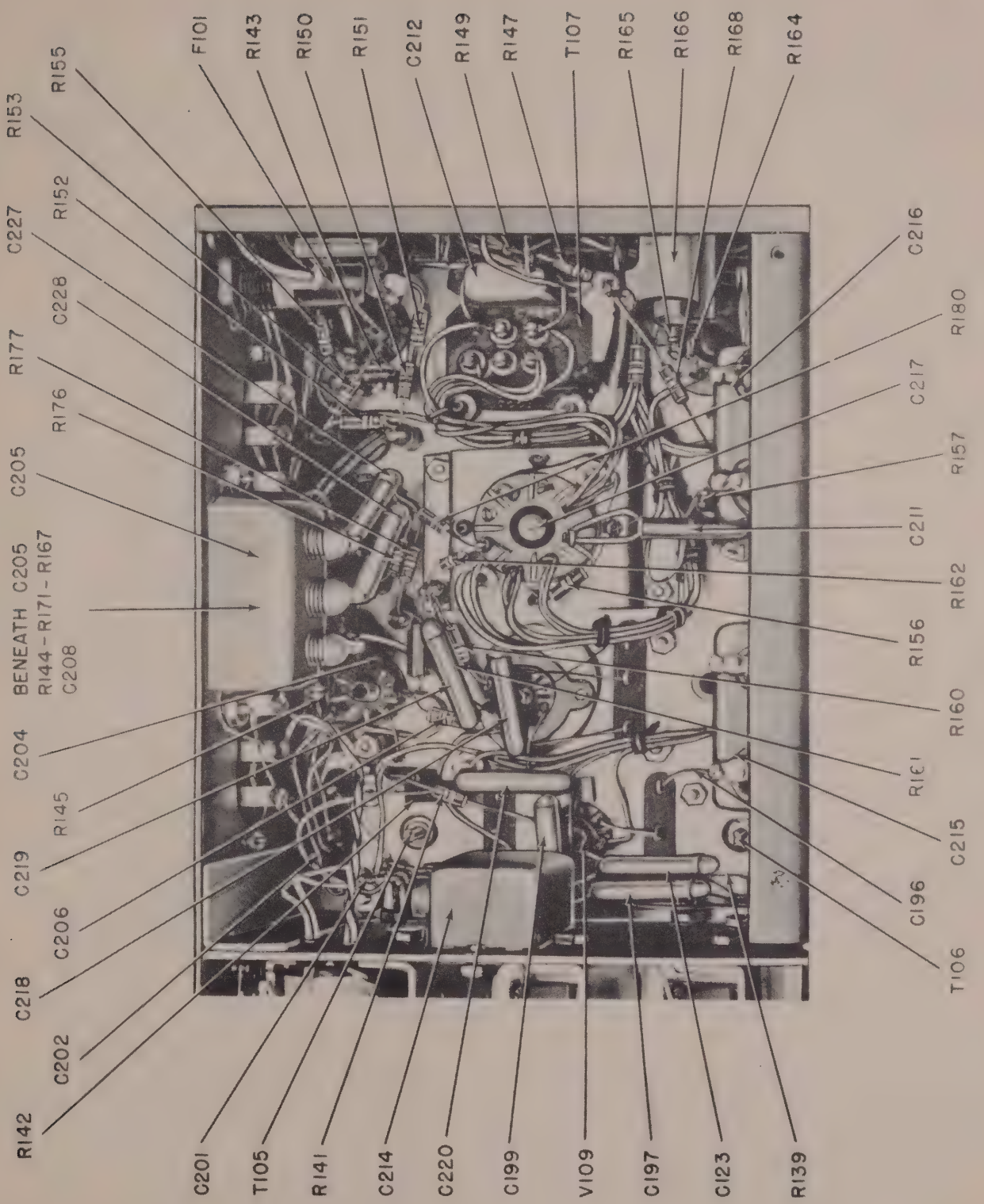



Figure 7-5. 51J-3 Bottom View, Compartment 2

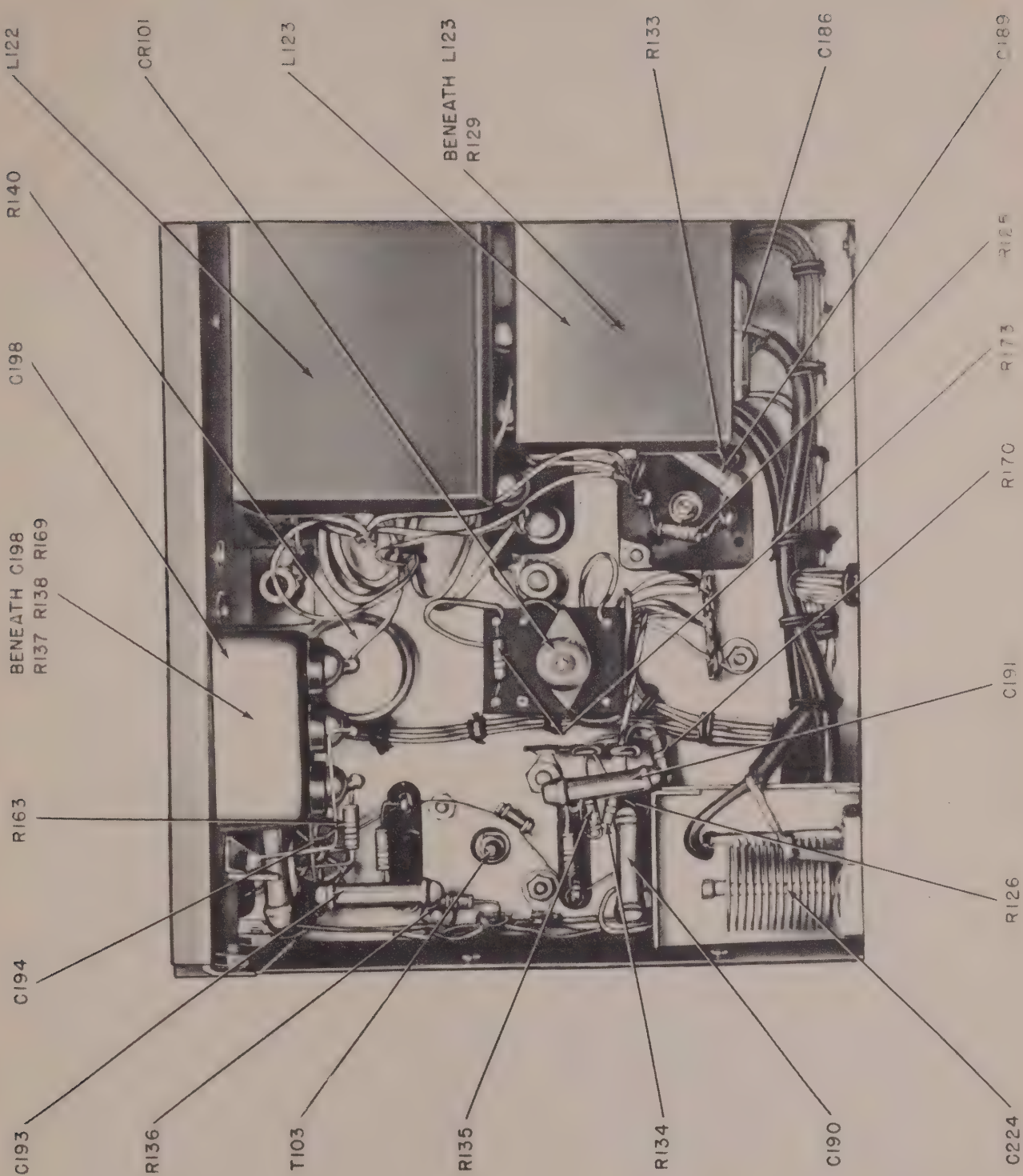



Figure 7-6. 51J-3 Bottom View, Compartment 3

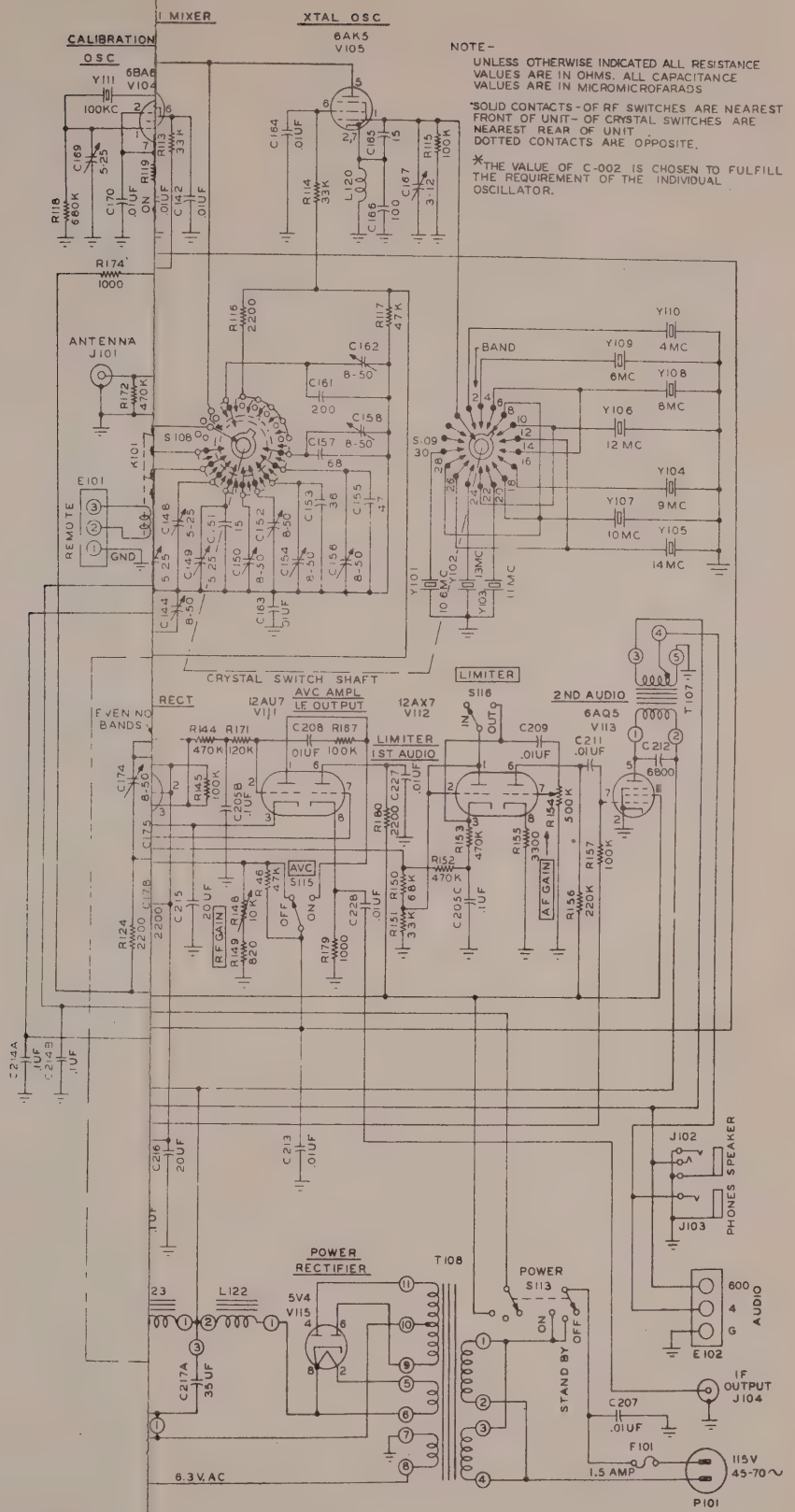



Figure 7-7. 51J-3 Main Schematic Diagram

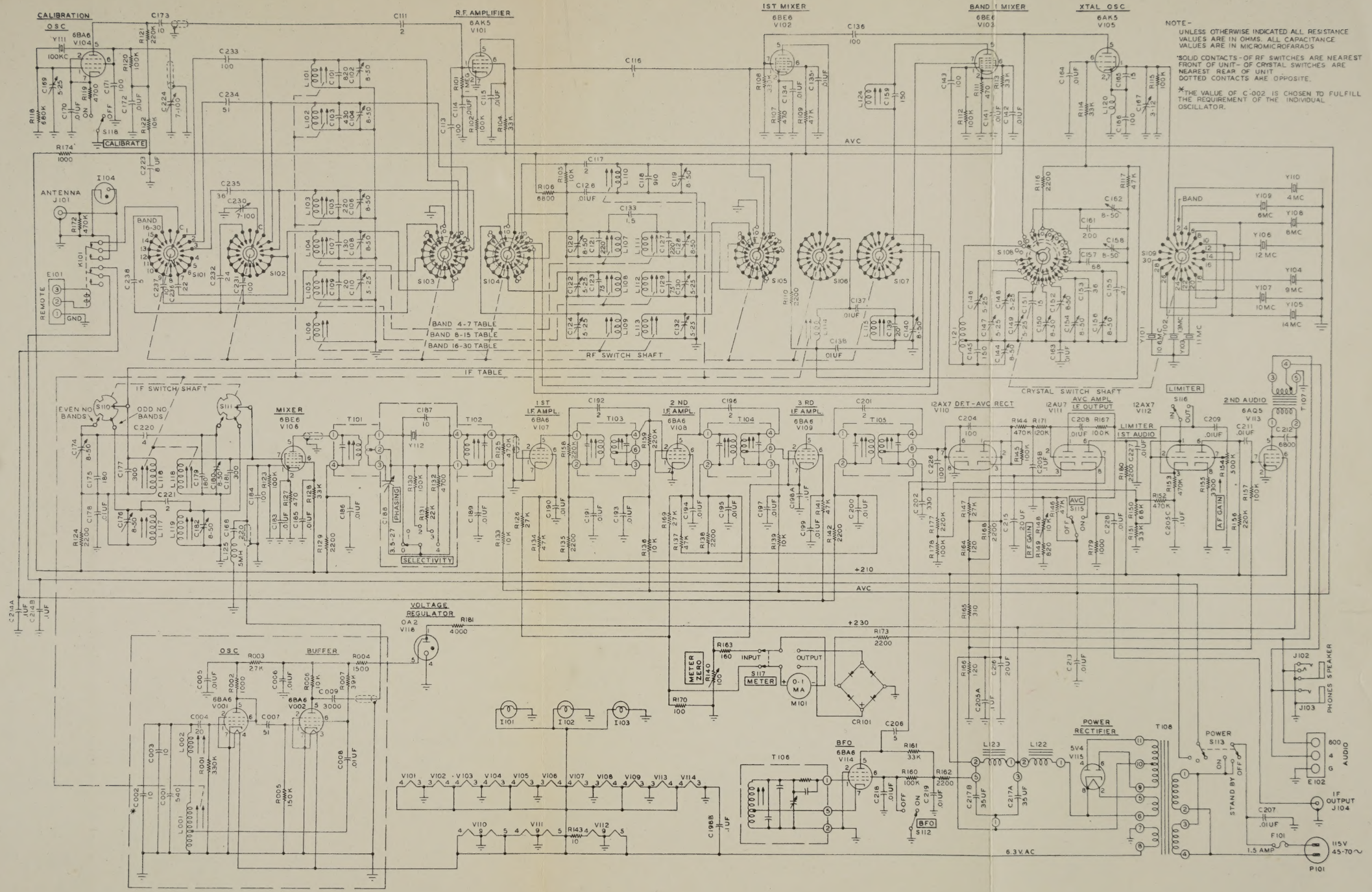



Figure 7-7. 51J-3 Main Schematic Diagram